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# AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

## PRELIMINARY ANNOUNCEMENT OF THE SEATTLE MEETING

**Edited by Dr. F. R. MOULTON**

PERMANENT SECRETARY

FROM June 17 to June 22, inclusive, the association will hold its summer meeting in Seattle, Washington, in cooperation with the Pacific Division. This will be the one hundred sixth meeting of the association and the twenty-fourth meeting of the Pacific Division. On two previous occasions the Pacific Division met in Seattle, the first in 1920 and the second in 1936. Twenty-seven affiliated and independent societies will participate in the Seattle meeting.

The fact that the association will not meet elsewhere than in Seattle this coming June adds nothing technically to the dignity of the meeting, for every meeting of the Pacific Division and of the Southwestern Division is a meeting of the association, and might well be announced as such. The vast size of our country makes it advisable to have administrative machinery for organizing and holding meetings on the Pacific Coast and in the great Southwest. The officers of the Pacific Division and the members of the association resident in its territory will be primarily responsible for the meeting in Seattle. The association refrains from holding a meeting elsewhere simply to encourage its members from the East to go westward and become better acquainted with their western colleagues. Many scientists from the Pacific Coast attend scientific meetings in the East; return visits will also be advantageous.

In addition to the meeting of the association, there are many other attractions for visitors to the Pacific Coast. Even the journey across country, whether by plane, train or motor, is in every way enjoyable. By plane the cost of the round trip from Washington to Seattle, including meals en route, is $224.80. A person leaving Washington, for example, at 5:30 P.M., or New York at 5:00 P.M., will arrive in Seattle at 9:40 the following morning, after simply an over-night trip. Those having a little more leisure may travel by luxurious air-conditioned trains, with the only change at Chicago. The round trip fare, including Pullman, is $176.30. The time from Washington or from New York by train is about three and one-half days. Those having still more leisure may motor practically the whole distance over fine concrete roads at a cost in time and money which will vary with the individual.

There is, however, much more to a transcontinental journey than time and expense—it is refreshing and inspiring to pass across the fertile great plains and through the mountains. There is a choice of two routes by plane and of several routes either by train or by motor; a person may go by one route and return by another for the same railway fare. Each of the possible routes passes through or near unsurpassed natural scenery—the lovely Lake Louise region in Canada; Glacier Park in Montana, where titanic forces have made mountains of overturned strata of rocks; Yellowstone Park in Wyoming, world-famed for its geysers, its mammoth hot springs, its petrified forests standing one above another in many layers, and its bears; Rocky Mountain National Park in Colorado; the Grand Canyon in Arizona; Mount Rainier in Washington; Crater Lake in Oregon; Yosemite Valley and the giant Sequoias in California. Seattle is a fine city approaching half a million in population, delightfully situated on an arm of the sea more than a hundred miles from the Pacific Ocean. Excursions have been arranged from Seattle to the Grand Coulee, Mt. Rainier, Olympic Peninsula and other places. The Golden Gate Exposition in San Francisco will be open. But I must write about the meeting.

### Headquarters and Hotels

The general headquarters of the meeting will be in the Benjamin Franklin Hotel, which has 340 rooms, each with a bath. The rates range for single rooms from $2.50 to $6.00 per day; for double rooms, from $3.50 to $12.00 per day. Rates for rooms with baths in other hotels are as follows:

Olympic: Single, $3.50 to $8; double, $5 to $12.
Roosevelt: Single, $2.50 to $6; double, $3.50 to $8.
New Washington: Single, $3 to $5; double, $4 to $7.
Mayflower, Single, $2.50 to $4; double, $3.50 to $6.
Edmond Meany: Single, $2.50 to $4; double, $3.50 to $7.
Camlin Apartment: Single, $1.50 to $2.50; double, $2 to $3.50.
Gowman: Single, $2.50 to $4; double, $3.50 to $7.

The Calhoun, Earl, Frye, Hungerford, Moore, Morrison, New Richmond and Seattle have rooms at lower rates. In addition, there are numerous automobile camps within 3.5 miles of the university campus at which modern cabins may be rented from $1.50 to $6.00 per day.

Registration headquarters will be located in Bagley Hall, University of Washington campus.

### General Sessions

On Tuesday evening, June 18, Dr. Lewis M. Terman, of Stanford University, retiring president of the Pacific Division, will deliver an address on "Psychological Approaches to the Biography of Genius."

On Wednesday evening, June 19, Dr. Ernest O. Lawrence, of the University of California, who was awarded a Nobel Prize last autumn for his invention of the cyclotron and his work with it, will deliver the ninth Maiben Lecture. His address, which will be illustrated, will be on "Building Atoms."

On Thursday evening, June 20, F. A. Banks, construction engineer of the Grand Coulee Dam, will deliver an illustrated lecture on the dam.

On Wednesday afternoon, June 19, at 4:30, Dr. Donald Milton Erb, president of the University of Oregon, will deliver an address under the sponsorship of Pi Gamma Mu on "Perspective in the Social Sciences."

### Symposia

Symposia are steadily becoming more and more important and characteristic features of meetings of the association. They present unexcelled opportunities for cooperation by scientists in different fields; they promote cross fertilization of ideas; they are likely to be systematically organized and comprehensive; they are participated in by high authorities; and some of them are published by the association. At the Seattle meeting the following symposia will be presented:

*The American Physical Society.* On Wednesday morning, June 19, the society will present a symposium on "Cosmic Rays" at which Hans A. Bethe, Arthur H. Compton and Robert A. Millikan will present papers.

On Thursday morning the society will present a symposium on "Nuclear Moments" to which the contributors will be N. F. Ramsey and J. R. Zacharias, followed in the afternoon by a discussion of "Theoretical Physics" led by J. R. Oppenheimer.

*The Astronomical Society of the Pacific.* The society will present two symposia, one on Wednesday morning, June 19, on "Sources of Stellar Energy" and a second on Thursday afternoon on "Applications of the Photo-

Electric Cell to Astrophysical Research," the contributors to which will be Joel Stebbins, A. E. Whitford, John S. Hall, Gerald E. Kron and C. S. Beals.

The Section on Zoological Sciences (George A. Baitsell, reporting) will hold a joint symposium with the Western Society of Naturalists on "The Species Problem" on Tuesday and Wednesday mornings under the chairmanship of Robert C. Miller.

*The American Society of Ichthyologists and Herpetologists.* The society will present a symposium, W. M. Chapman, chairman, on "Salmon Problems on the Pacific Coast of North America," the contributors to which will be P. R. Needham, A. L. Pritchard, F. A. Davidson, D. W. H. Rich, G. H. Clark, L. A. Royal and J. A. Craig.

*The Botanical Society of America, Pacific Division, and the American Society of Plant Physiologists.* On Wednesday morning, June 19, the societies in cooperation with the Section on Botany will present a symposium on "Aquatic Botany," George B. Rigg, presiding, at which papers will be read by Gilbert M. Smith, John Raper, G. J. Hollenberg, Lyman D. Phifer, J. van Overbeek and Dan Bonnell.

On Thursday morning and afternoon the societies and the section will present a joint symposium on "Recent Investigations of the Characteristics of the Photosynthetic Process," H. A. Spoehr, presiding, the contributors to which will be Hans Gaffron, Robert Emerson, Winston M. Manning and Herbert M. Dutton, S. Ruben, William Arnold and C. B. van Niel.

*The American Phytopathological Society.* On Friday morning, June 21, the society will present a symposium on "Virous Diseases of Fruit Trees," consisting of invited papers followed by discussions of methods of investigating virous diseases of various fruit trees.

*The American Society of Plant Physiologists and the Western Society of Soil Science.* On Tuesday, June 18, the societies will present a symposium, H. D. Chapman, chairman, on "Phosphate Nutrition and Phosphate Fertilization."

*The Ecological Society of America and the Society of American Foresters.* On Wednesday afternoon the societies will present a symposium on "Forest Influences and Land Use Problems," J. H. Hanley representing the former society and C. S. Cowan the latter. The speakers will be R. F. Daubenmire, Leo A. Isaac, L. C. Wheeting and E. N. Torbert.

*Section on Social and Economic Sciences.* The section will present five symposia (dates not stated) on social and economic problems relating to the Pacific Northwest, the subjects of which are: (1) "Population Trends, with Special Reference to the Pacific Northwest"; (2) "Migration and Settlement: Patterns and Trends"; (3) "The Economy of the Pacific Northwest in its National Setting"; (4) "Standards of Living and Employment: Problems of Community Insecurity"; and (5) "Employer-Employee Problems and Relations."

## Section and Society Programs

*American Mathematical Society* (T. M. Putnam, reporting). On Thursday morning, June 20, the society will hold a joint session with the American Physical Society at which John von Neumann will present a paper "On Operator Rings and Dimensions." In the afternoon the society, under the chairmanship of its president, G. C. Evans, will hold a session for the presentation of papers by members of the society. In the evening the society will hold a joint dinner with the Section on Mathematics at 2211 Interlake Boulevard.

*American Physical Society* (Paul Kirkpatrick, reporting). On Tuesday afternoon, June 18, the society will hold a joint session with the American Association of Physics Teachers for a discussion of "Training at the College Level."

On Wednesday morning the society will hold a session for the presentation of a symposium on "Cosmic Rays" at which the speakers will be Hans A. Bethe, Arthur H. Compton and Robert A. Millikan. On Wednesday noon members and guests of the society will join in a luncheon at Hotel Edmond Meany. On Wednesday afternoon the society will hold a joint meeting with the Astronomical Society of the Pacific, at which G. M. Volkoff, of the University of California, will be one of the speakers.

On Thursday morning, in addition to the joint session with the American Mathematical Society, previously mentioned, the society will present a symposium on "Nuclear Moments" (see Symposia). In the afternoon the society will hold a symposium on "Theoretical Physics."

On Friday morning and afternoon and on Saturday morning the society will hold a session for the presentation of short contributed papers, abstracts of which will appear in the printed program of the society.

*American Association of Physics Teachers* (A. A. Knowlton, reporting). In addition to the previously mentioned joint session with the American Physical Society on Tuesday afternoon, June 18, the society will meet on Tuesday morning and on Friday, both morning and afternoon, for the presentation of contributed papers. On Wednesday the society will hold no formal sessions.

*The American Meteorological Society* (Phil E. Church, reporting). The society will meet from Wednesday afternoon to Friday evening, June 19–21, inclusive. On Wednesday afternoon five papers (Phil E. Church, presiding) will be presented by representatives of Pacific Coast Weather Bureau Stations as follows: J. R. Fulks and R. A. Dightman, Rex Rhoten, H. N. Weirauck, W. C. Jacobs and Carlton Jencks.

On Thursday morning the discussion will be continued (J. Bjerknes, of Bergen, Norway, presiding) with papers by L. H. Daingerfield, Phil E. Church, and T. Edward Stephens. On Thursday afternoon the society will hold a joint session with the Hydrology Section of the American Geophysical Union and the Western Interstate Snow Survey Conference.

On Friday morning the society will hold a session (L. H. Daingerfield, presiding) for contributed papers. The speakers at this session will be Wendell Woodward, Archer B. Carpenter and Rex Rhoten, Philip Williams, Jr., Thomas E. Jermen, Richard A. Dightman and N. E. Bradbury and E. Fryer. After a luncheon at the Edmond Meany Hotel, the society will hold a final session with N. E. Bradbury presiding. Papers will be presented at this session by R. A. Halvorsen, I. Gringorten and J. Bjerknes, of Bergen, Norway.

*The American Chemical Society, Western Intersectional Meeting* (H. V. Tartar, reporting) will hold three sessions, two on Wednesday and one on Thursday morning, at which 32 papers will be presented. The society will hold a joint dinner with the Puget Sound Section in the Edmond Meany Hotel on Wednesday evening.

At the session on Wednesday morning, June 19, the speakers will be George S. Parks, Theo West and George E. Moore, O. Redlich and J. Bigeleisen, R. W. Gelbach and G. Brooks King, L. I. Gilbertson, Ralph L. Tiede and James A. Cox, G. Brooks King, C. H. Secoy and G. H. Cady, Philip W. Schutz and Aaron E. Markham and Kenneth A. Kobe. At the afternoon session papers will be presented by Anton B. Burg, E. C. Gilbert and Ned Baker, M. J. Marshall, H. O. McMahon and W. L. Godson, Robert D. Vold, Arthur F. Scott, Irving Jolley, and J. L. Culbertson, Lester Winter and Alfred Stockfleth.

On Thursday morning papers will be presented by James W. Ferguson, A. R. Olson and P. V. Youle, E. V. White, E. R. Norris and J. D. Hauschildt, Loring R. Williams and Arthur C. Twomey and Sarah J. Twomey, J. S. Butts, Paul B. Donavon and George F. Harsh, William Ure and F. T. Fitch and J. H. Kemper, W. F. Seyer, Andrew van Hook, Leo Friedman and Robert Lovin, J. P. Mehlig, Lloyd E. West, B. E. Christensen and Robert Wong and W. H. Kunz.

*The Astronomical Society of the Pacific* (T. S. Jacobsen, reporting) will hold sessions for the presentation of papers on Wednesday and Thursday, June 19–20, a dinner of the society on Thursday evening.

On Wednesday afternoon the society will present a joint symposium with the sections on physics and astronomy on "Sources of Stellar Energy," and on Thursday afternoon the society will hold a symposium on "Applications of the Photoelectric Cell to Astrophysical Research" (see Symposia). In the evening R. M. Petrie will deliver a lecture on "Solar Kinematography" illustrated by motion pictures.

Among those who will present papers at the sessions on Wednesday and Thursday mornings are N. U. Mayall and L. H. Aller, Betty Adams, W. H. Wright, Doris Roosen-Raad and F. J. Neubauer, A. H. Joy, D. N. Davis, Paul W. Merrill and Roscoe F. Sanford, E. Pettit, and R. S. Richardson.

*Section on Geology and Geography and the Geological Society of America* (Howard A. Meyerhoff, reporting) will hold four sessions for the presentation of papers and conduct three field excursions. The sessions of the section and society will be held on Monday afternoon, June 17, both morning and afternoon on Tuesday, and Wednesday morning, leaving members free on Thursday and Friday to attend the sessions of the Association of Pacific Coast Geographers on June 20–21 or to participate in the field trips of the section.

A field excursion on Thursday, June 20, under the leadership of G. E. Goodspeed, will be for the purpose of considering petrologic problems in the Cascade Mountains; a second field excursion, led by J. Hoover Mackin, will be for the purpose of examining glacial phenomena in the Puget Sound lowland and along the western slope of the Cascade range. The activities of the section will be concluded by a three-day field excursion in the Cascades and the Columbia Plateau, under the leadership of A. C. Waters and J. Hoover Mackin. The excursion will include the more important geological problems and cover the more interesting scenic areas in the state of Washington. Persons desiring to participate in this excursion should communicate by June 10 with J. Hoover Mackin, University of Washington, Seattle.

*The Oceanographic Society of the Pacific* (C. L. Utterback, reporting) will hold a conference on Wednesday afternoon, June 19, on "The Distribution and Cycle of Organic Matter in the Ocean," and its annual luncheon on Thursday noon.

*Association of Pacific Coast Geographers* (Peveril Meigs, president). This, the sixth annual meeting of the society, will consist of six sessions, three on Thursday, June 20, two on Friday and one on Saturday, a luncheon on Thursday noon at the Edmond Meany Hotel, the annual dinner on Friday evening at the same hotel, at which the president, Peveril Meigs, will deliver an address on "Exploring American Orchards," and a boat trip around Seattle Harbor on Saturday afternoon (tickets $1 each).

At the first session on Thursday morning seven papers will be presented, the speakers being Norman Carls, Leda Hamilton, Gertrude McKean, Elizabeth Schreiber, Harold E. Tennant, Hallock F. Raup, and James F. Chamberlain. On Thursday afternoon the program will consist of seven papers by A. W. Kuchler, John E. Kesseli, Joseph T. Hazard, Walter Hacker,

Howard H. Martin, Willis B. Merriam and Warren D. Smith. On Thursday evening a program of four papers will be presented, the speakers being Forrest Shreve, Frances M. Earle, Richard G. Tyler and Maxim von Brevern.

The Friday morning session will consist of seven papers, the authors being Phil E. Church, Ernestine Hamburg, Tim K. Kelley, Howard E. Pepke, R. S. Shaw, Harold Rhodes, and Otis W. Freeman. At the afternoon session six papers will be presented, the speakers being William H. Pierson, W. Ross Pence, Albert L. Seeman, Margaret Thompson, Woodrow R. Clevinger and J. Wright Baylor.

On Saturday morning papers will be read by Carl H. Mapes, Elmer D. Fullenwider, Julia A. Shourek, Worth McClure and Erna Grassmuck Gilland, after which the annual business meeting of the society will be held.

*The American Geophysical Union, North Pacific Regional District and North Continental Divide Area of the Section of Hydrology* (George G. West, reporting) will hold sessions for the presentation of papers on Thursday afternoon, June 20, and on Friday morning and afternoon. On Saturday the society will conduct an excursion which will include an inspection of Lake Washington Bridge, the City Light Skagit Project, Diablo Power House and Dam and the Ross Dam Site. The cost of the trip, including transportation, lodging and three meals, will be $4.05.

On Thursday afternoon the society will hold a joint session with the Western Interstate Snow Survey Conference (Phil E. Church, chairman) at which papers will be presented by J. E. Church, H. B. Atkinson and Clyde E. Bay, Walter J. Parsons and H. C. Dukes, and Walter J. Parsons.

At the session on Friday morning (J. C. Stevens, presiding) papers will be presented by Fred Merryfield, George F. Hopkins and H. P. Gillette, following which the society will hold a joint luncheon with the Western Interstate Snow Survey Conference at the Edmond Meany Hotel. A motion picture film, "From the Snow Field to the House," will be shown by the Washington Water Power Company. On Friday afternoon the society will hold a session at which papers will be presented by James C. Marr, D. B. Freeman, O. N. Rugen, and a review of an article of George W. Mindling by Clarence Pedersen.

*The Oceanographic Society of the Pacific* (C. L. Utterback, reporting) will hold a session on Wednesday afternoon, June 19, for a conference on "The Distribution and Cycle of Organic Matter in the Ocean" and will hold a luncheon on Thursday noon.

*The Western Interstate Snow Conference* (Phil E. Church, reporting) will hold sessions on Wednesday morning and afternoon, a third session on Thursday morning, a joint session on Thursday afternoon with the American Geophysical Union, North Pacific Regional District and North Continental Divide Area of the Section on Hydrology, a luncheon on Wednesday noon at the Edmond Meany Hotel, and a dinner Thursday evening at the same place.

At the session on Wednesday morning the speakers will be Paul A. Bean and Paul Webster Bean and Frederick A. Bendtsen, John V. Salo, George D. Clyde, Carl Elges, H. P. Boardman and J. S. Moore. In the afternoon papers will be presented by J. Cecil Alter, R. A. Work, John T. Ryan, Philip S. Cowgill, Carl Elges, J. C. Stevens, and Paul A. Bean and Paul Webster Bean and Frederick A. Bendtsen.

The papers on the Thursday morning program will be by W. W. McLaughlin, Frank Kittredge and W. G. Waterhouse, Charles A. Connaughton, J. Carlisle Crouch, and Phil E. Church. At the dinner on Thursday evening color motion pictures on Snow Surveying in the Central Sierra will be shown by Walter Herz.

*The Section on Zoological Sciences* (George A. Baitsell, reporting) will hold a joint symposium with the Western Society of Naturalists on "The Species Problem" on Tuesday and Wednesday mornings under the chairmanship of Robert C. Miller.

*The American Association of Economic Entomologists, the Pacific Slope Branch* (Roy E. Campbell, reporting) will hold its twenty-fifth annual meeting on Thursday and Friday, June 20–22, partly with the Northwest Association of Horticulturists, Entomologists and Plant Pathologists. The annual dinner of the society will be held on Friday evening, at which the principal speaker will be E. O. Essig. An excursion to Victoria for Saturday is under consideration.

*The American Society of Ichthyologists and Herpetologists* (Margaret Storey, reporting) will meet on Wednesday and Thursday, and on Friday it will conduct an excursion to the fish establishments along the Seattle waterfront. The feature of the program of the society will be a symposium on "Salmon Problems on the Pacific Coast of North America" (see Symposia).

*The Pacific Northwest Bird and Mammal Society* (Arthur Svihla, reporting) will hold sessions on Tuesday morning and afternoon before which a total of 11 papers will be presented.

The contributors to the morning program will be R. L. Webster, I. McT. Cowen, W. Dalquest, Miss E. L. Curtis, Hugh Hotson and J. E. Guberlet. The papers in the afternoon will be presented by Arthur Svihla, G. E. Hudson, V. B. Scheffer, Earl Larrison, Staley G. Jewett and Roy E. Rosenberg.

*The Botanical Society of America, Pacific Division* (Ira L. Wiggins, reporting) will hold sessions from Tuesday to Saturday, June 18–22, inclusive, at which 26 papers will be presented, including 6 in a symposium on "Aquatic Botany" and 7 in a symposium on

"Recent Investigations of the Characteristics of Photosynthesis."

At the sessions on Tuesday papers will be presented by Ira L. Wiggins, A. S. Crafts, Katherine Esau, Robert H. Williams and Geo. B. Rigg, Norman Boke, and Geo. B. Rigg and Lyman D. Phifer.

The business meeting of the society will be held on Wednesday morning, following which the society will hold a joint session with the Section on Botanical Sciences (C. Leo Hitchcock, presiding), at which papers will be presented by Ruth Svihla, T. C. Frye and Lois Clark, Carl Epling and Harlan Lewis, Alan A. Beetle, Mildred E. Mathias and Lincoln Constance, Herbert L. Mason, and C. Leo Hitchcock. On Wednesday afternoon the society, in joint session with the Section on Botany and the American Society of Plant Physiologists (George B. Rigg, presiding), will present a symposium on "Aquatic Botany" (see Symposia).

On both Thursday morning and afternoon the society will hold joint sessions with the Section on Botany and the American Society of Plant Physiologists (H. A. Spoehr, presiding), at which a symposium on "Recent Investigations of the Characteristics of the Photosynthetic Process" will be presented (see Symposia).

On Friday there will be a field excursion to the Olympic Peninsula, and on Saturday there will be a joint excursion with the American Society of Plant Physiologists to Friday Harbor.

*The American Phytopathological Society* (L. D. Leach, reporting) will hold sessions from Wednesday to Saturday, June 19–22, inclusive, in connection with the Pacific Division of the society. The first session will open with a business meeting and the election of officers. The remainder of the day will be devoted to the presentation of papers on research projects.

On Thursday morning the society will meet with the Society for Horticultural Science, the American Association for Economic Entomologists, and the Northwest Association of Horticulturists, Entomologists and Plant Pathologists, at which K. Esau, representing the society, will present a paper. The afternoon session will be devoted to the presentation of submitted papers.

On Friday morning the society will hold a symposium on "Virous Diseases of Fruit Trees" followed by discussions of methods of investigating virous diseases on various fruit trees. On Saturday the society will join the all-day field trip to the Western Washington Experiment Station at Puyallup.

*The American Society of Plant Physiologists,* Western Section (J. van Overbeek, reporting) will meet June 18–22, inclusive. The program will consist of three symposia and four sessions for the presentation of submitted papers. The first symposium will be held jointly with the Western Society of Soil Science on June 18, H. D. Chapman, chairman, on "Phosphate Nutrition and Phosphate Fertilization." On June 19 the society will hold a joint symposium with the Botanical Society of America on "Aquatic Botany," under the chairmanship of George B. Rigg. The third symposium will also be held jointly with the Botanical Society of America on "Recent Investigations of the Characteristics of the Photosynthetic Process." One of the sessions for the presentation of submitted papers will be held jointly with the Society for Horticultural Science. On Saturday, June 22, the society will conduct an excursion to the Oceanographic Laboratories of the University of Washington, at Friday Harbor.

*The Ecological Society of America* (H. de Forest, reporting) will hold sessions on Wednesday and Thursday and field excursions to a sphagnum bog, a forest, a lake, a beach at low tide (Saturday about noon), a gravelly prairie, a salt marsh, and a swamp. At the session on Wednesday morning Joseph Kittredge, Jr., will preside. The afternoon program on Wednesday will be a joint session with the Society of American Foresters for the presentation of a symposium on "Forest Influences and Land Use Problems." C. S. Cowan, representing the Society of American Foresters, and J. H. Hanley, representing the Ecological Society of America, will preside at the symposium. On Wednesday evening the Biologists' Dinner will be held. At 1:30 on Thursday afternoon a motion picture on the transplanting of Columbia River salmon and trout will be exhibited, followed by a session for the presentation of papers under the chairmanship of H. de Forest.

*The Section on Anthropology* (Erna Gunther, reporting) will present a program (date not stated) which will include papers by Alexander Goldenweiser, Thomas Horace Evans, Donald Collier, Viola Garfield, Melville Jacobs, Verne Ray and others.

*The Society for Research in Child Development* (Stevenson Smith, reporting) will hold sessions on Thursday, June 20. The morning program will consist of papers by Sara W. Prentiss, Hubert S. Coffey, Edith A. Davis, Norman W. Clein and Miriam Forster. The afternoon program will consist of a panel discussion by Virginia Lee Block, Catherine Landreth, Vera Brandon and Max Houtchens.

*Section on Social and Economic Sciences* (Holbrook Working, reporting) will hold five sessions at which five symposia will be presented on social and economic problems of the Pacific Northwest. The subjects of the five symposia are: "Population Trends, with Special Reference to the Pacific Northwest"; "Migration and Settlement: Patterns and Trends"; "The Economy of the Pacific Northwest in its National Setting"; "Standards of Living and Employment; Problems of Community Insecurity"; and "Employer-Employee Problems and Relations."

*The Institute of the Aeronautical Sciences* (C. E. Sinclair, reporting) will hold sessions on Friday, June 21. Papers will be presented on various aspects of "Transoceanic and High Altitude Flight."

*The Society for Experimental Biology and Medicine, Pacific Coast Branch and Southern California Branch* (Charles Weiss, reporting) will hold sessions on Wednesday, June 19, at which 21 research papers in the field of experimental biology and medicine will be reported. Abstracts of the papers are all in the hands of both the secretary of the society and the permanent secretary of the association. The contributors to this program are William F. Allen, Kurt Aumann and W. B. Youmans, Hance F. Haney and Arne Lindgren, Max Kleiber and Harold H. Cole, O. Larsell and S. von Berthelsdorff, John S. Lingenfelter, Ira A. Monville and T. W. Spencer, Edwin E. Osgood with technical assistance of Evelyn Packham, Nilkanth M. Phatak, F. B. Zener and N. A. David, Walter van Winkle, Homer Wheelon, W. B. Youmans, A. Marshak, Dan H. Campbell and Paul A. Nicoll, Bradley T. Scheer, Albert Tyler, Charles B. Metz and Albert Tyler, Edward B. West, W. R. Todd, A. J. Lesser and Francis Marsh Baldwin and Milton Metefessel.

*The Society of American Bacteriologists, Southern California Branch and Northern California-Hawaiian Branch* (B. S. Henry, reporting) will hold sessions on Thursday morning and afternoon, June 20. At the morning session papers will be presented by F. P. Griffiths, C. E. ZoBell, E. C. McCulloch, E. J. Ordal, W. V. Halversen, B. S. Henry and J. S. Kiser, and R. S. Weiser and W. Leif. On the afternoon program the speakers will be M. R. Greene, H. J. Sears, Anson Hoyt, M. D. Eaton, R. E. Hoffstadt, E. W. Schultz and B. Howitt.

*The American Society for Horticultural Science, Western Section* (W. W. Aldrich, reporting) will hold both morning and afternoon sessions for the presentation of papers on Wednesday, Thursday and Friday, June 19–21, the Thursday afternoon session being with the Northwest Association of Horticulturists, Entomologists and Plant Pathologists, the American Association of Economic Entomologists, Pacific Branch, and the American Phytopathological Society, Pacific Division.

At the session on Wednesday morning, W. M. Atwood, presiding, papers will be presented by J. B. Biale, W. O. Williams, S. H. Cameron, Harold E. Clark, Leif Verner, C. P. Harley and G. Howell Harris. E. L. Overholser will preside at the afternoon session at which papers will be presented by E. L. Overholser and F. L. Overly, Ormund Lilleland, F. M. Harrington and V. E. Iverson, G. G. Brown, W. W. Aldrich and J. R. Furr, C. L. Vincent, and O. M. Morris.

At the joint session on Thursday morning, Don C. Mote, presiding, papers will be read by Henry Hartman, Joseph C. Chamberlin, H. E. Morrison, and K. Esau. On Thursday afternoon, Leif Verner, presiding, papers will be read by Wilcox, C. E. Schuster, Elmer Hansen and Henry Hartman, R. W. Hodgson, C. W. Van Horn and A. H. Finch, F. L. Overly, G. H. Harris, Elmer Hansen and Henry Hartman.

A morning session will be held on Friday, John H. MacGillivray, presiding, at which papers will be presented by W. O. Williams, Henry Hartman, D. V. Fisher, J. H. MacGillivray, V. E. Iverson and F. M. Harrington, F. N. Harmon and Elmer Snyder, F. F. Halma, Thomas W. Whitaker, and F. M. Harrington.

*The Society of American Foresters* (C. D. Marckworth, reporting) will hold sessions for the presentation of papers on Tuesday and Wednesday, June 18 and 19, and on Thursday will sponsor a field trip to the Cedar River Watershed, Seattle's Municipal Forest.

At the session Tuesday morning, after introductory remarks by William H. Price, chairman, papers will be presented by Hugo Winkenwerder, Robert W. Cowlin, and Clyde S. Martin. At the afternoon session, under the chairmanship of Lyle F. Watts, papers will be presented by E. J. Hanzlik, Norman Jacobsen, and Alfred T. Hildman. At the dinner of the society on Tuesday evening Henry Schmitz will deliver an address.

On Wednesday morning the general subject will be "Utilization Problems of the Northwest," the speakers being R. B. Wolf, E. T. Clark, Gus Arneson, and Bror L. Grondal. On Wednesday afternoon the society will hold a joint session with the Ecological Society of America for the presentation of the symposium on "Forest Influences and Land Use Problems" (see Symposia).

*The Western Society of Soil Science* (L. T. Kardos, reporting) will hold sessions Monday, Tuesday and Wednesday, June 17–19. The sessions on Monday morning and afternoon will be for the reading of submitted papers. In the evening the society will hold a banquet and business meeting.

The morning session on Tuesday will be for submitted papers. On Tuesday afternoon the society will hold a joint symposium with the American Society of Plant Physiologists on "Phosphate Nutrition and Phosphate Fertilization," under the chairmanship of H. D. Chapman. On Tuesday evening the society will hold a round table discussion of "Fertilizer Placement Problems," S. C. Vandecaveye, chairman.

The session Wednesday morning will be devoted to submitted papers. In the afternoon there will be a round table discussion on "Coordination of Research Programs in Western Phosphate Utilization," under the chairmanship of R. H. Walker.

*The Northwest Association of Horticulturists, Ento-*

*mologists and Plant Pathologists* (Don C. Mote, reporting) will hold sessions on Thursday to Saturday, June 20–22. The society will hold joint sessions with the American Association of Economic Entomologists, Pacific Slope Branch; the American Society for Horticultural Science, Western Section; and the American Phytopathological Society, Pacific Division. Among the speakers on these programs will be Henry Hartman, Joseph C. Chamberlin, H. E. Morrison, and K. Esau. On Saturday the society will hold a business meeting and a demonstration program of spraying and dusting and exhibits at the Western Washington Experiment Station, Puyallup, Washington.

*The Section on Education and the Section on Psychology* (John E. Corbally, reporting) will meet on Friday, June 21. The morning program will consist of papers by Leonard Carmichael, E. R. Guthrie, H. H. Remmers, C. T. Williams, Doncaster G. Humm, C. W. Stone and O. W. Freeman. The afternoon session, under the chairmanship of Edward G. Olsen, will consist of a panel discussion on "The Utilization of Community Resources for Educational Purposes," the participants in the discussion being Helen Strong, Theodore Siedle, C. W. Stone, O. W. Freeman, E. M. Draper, George E. Griffith, Hugo Winkenwerder, George Yantis, and Worth McClure.

# OBITUARY

## DR. GLENN E. CULLEN

IT is with a feeling of deep sadness, mingled with pleasant memories that we pause to review the career of Glenn E. Cullen. His death occurred in Cincinnati on April 11, following a short illness, the cause of death being a coronary occlusion. Born on the Isle Saint George, Ohio, he attended high school at Sandusky, and later entered the University of Michigan, receiving the degree of A.B. in 1912 and of B. Chem. Eng. the next year. Between 1913 and 1922 he was research chemist at the Rockefeller Institute for Medical Research. Here, while working with Donald D. Van Slyke and O. T. Avery, his interest for biochemistry and medical science was aroused. During this period he was actively engaged in many problems. With Van Slyke and O. T. Avery, his interest in biochemistry of the blood plasma under constant carbon dioxide tension and also the details of the method for the determination of urea in urine and blood using the enzyme urease were developed. With a number of colleagues he worked on the technique for the collection and analysis of blood and for its saturation with gas mixtures of known composition. He received the degree of Ph.D. from Columbia in 1917. His method for the colorimetric determination of the hydrogen ion concentration in blood plasma and his modification of the Clark hydrogen electrode vessel are well known to all workers in this field of investigation. During the World War, he was a captain in the Sanitary Corps, War Demonstration Hospital, New York City.

Dr. Cullen became associate professor of research medicine at the University of Pennsylvania in 1922. While there he investigated the changes in acid-base condition of the blood during and following ether anesthesia, in diabetic coma and in gastro-enteritis. With Dr. J. Harold Austin, he published the monograph on "Hydrogen-ion Concentration of the Blood in Health and Disease."

In 1924, Dr. Cullen was appointed professor of biochemistry at the School of Medicine of Vanderbilt University. Before proceeding to Nashville he spent a year at the Riggs Hospital, Copenhagen, as a traveling fellow of the Rockefeller Foundation. During this visit, researches were begun on the quinhydrone electrode which were later continued in Nashville.

Dr. Cullen was greatly interested in medical education and also in the graduate schools of America. As a member of the executive faculty of the Medical School at Vanderbilt he gave much of his time and energy to problems outside of the department he guided. He was instrumental in the reorganization of the Graduate School of Vanderbilt.

From this post he came to Cincinnati to be associated with Dr. A. Graeme Mitchell in the Children's Hospital Research Foundation and in the department of pediatrics, College of Medicine, University of Cincinnati, where he was professor of research pediatrics and director of laboratories. He was also professor of biochemistry and a fellow of the Graduate School. His energies overflowed into all things pediatric and also into those activities of the medical school campus in which he was always concerned. It is a significant fact that Dr. Cullen was the first member of the Pediatric Society who did not hold a Doctor of Medicine degree. In spite of being a doctor of philosophy, those of his colleagues with whom he made rounds would hardly be aware of the fact that he had not been trained for many years as a pediatrist. His thinking through of the problems of the laboratory as they relate to the clinic made a tremendous contribution to his own department and pediatrics in general.

Dr. Cullen was very active in the American Society of Biological Chemists. He was treasurer 1926–30, vice-president 1935–36, president 1937–38. In the absence of the president and vice-president he took the full responsibility of administration of the society at its meeting this year in New Orleans. He was chairman of the executive committee of the Federation of

American Societies for Experimental Biology in 1938–39, directing the meeting in Toronto in 1939.

His wide interests in the scientific world may be judged from his many society memberships, including the American Chemical Society, the American Association for the Advancement of Science, the Society for Experimental Biology and Medicine, Harvey Society, American Academy of Pediatrics, the American Pediatric Society, the Society of Pediatric Research, the American Institute of Nutrition, Central Society for Clinical Research, Sigma Xi and his associate membership in the American Medical Association. He has served on the National Research Council, and on the committee of cooperation with chemical warfare service of the American Chemical Society.

Dr. Cullen possessed tremendous vitality and energy, which he applied to all of his interests as well as to the things he opposed. He was in the center of everything that crossed his path and always worked to make the machine run more efficiently. He gave wise and constructive counsel in a manner that was typically his own. Even when his criticism seemed harsh, the real spirit of his desire to help was always revealed. Greatly loved and admired by his colleagues and students, his life exemplified the classic line of Philip James Bailey, "He most lives—who thinks most—feels the noblest—and acts the best."

HOWARD W. ROBINSON
CHILDREN'S HOSPITAL RESEARCH FOUNDATION,
CINCINNATI, OHIO

## RECENT DEATHS AND MEMORIALS

PROFESSOR FRANK H. PROBERT, professor of mining and dean of the College of Mining of the University of California at Berkeley, died on May 7 at the age of sixty-four years.

DR. JOHN C. HAMMOND, from 1917 to 1934 astronomer at the U. S. Naval Observatory, with which he had been connected since 1898, died on May 12 in his sixty-eighth year.

DAVID BARKER RUSHMORE, consulting engineer of New York City, from 1905 to 1925 chief engineer of the General Electric Company, died on May 5 in his sixty-seventh year.

PROFESSOR OLIVER WESLEY DYNES, head of the department of agronomy in the College of Agriculture and associate in agronomy in the Agricultural Experiment Station of the University of Tennessee, died on May 6 at the age of fifty-nine years.

DR. CALVIN B. COULTER, associate professor of pathology at the Long Island College of Medicine and bacteriologist-in-chief at Kings County Hospital, Brooklyn, N. Y., died on May 10. He was fifty-two years old.

IT is reported in the daily press that Professor Lewis B. Allyn, of the Research Laboratories of Westfield, Mass., was fatally shot in his home on May 8. He was sixty-six years old.

PHILIP W. MESERVE, professor of chemistry at Bowdoin College, died, apparently by suicide, on May 10. He was in his fifty-first year.

AT a recent ceremony attended by the faculty of the College of the City of New York, a memorial plaque was dedicated to the late Professor Frederic O. X. McLoughlin, which was presented to the college by Dr. Frederick B. Robinson, former president, who sculptured the memorial himself. It was placed in the main hall of the Engineering Building. Professor McLoughlin, who died in 1936, was professor of civil engineering at the college and was among the earliest members of the engineering faculty.

THE London *Times* states that the one hundred and fiftieth anniversary on April 17 of the death of Benjamin Franklin, American philosopher, statesman and writer, is to be commemorated at Northampton by the establishment of a Franklin Memorial Union. An inaugural meeting will be held soon, and the speaker of the House of Commons, the president of the Royal Society and the president of the French Academy of Sciences have consented to be patrons. Franklin had several intimate associations with the town and county of Northampton, and the union's first object will be to spread, by lectures, pamphlets and so on, knowledge of his manifold achievements. Franklin scholarships may be instituted, or a Franklin memorial hall erected for the public use, or an endowed Franklin foundation established for the special study of philosophy and natural science.

# SCIENTIFIC EVENTS

## THE BRITISH ASSOCIATION[1]

THE British Association intends, unless unforeseen events intervene, to hold a conference in the University of Reading, by kind permission of the council of the university, during July 25–27. The general reference will be to science in national and international aspects, and Sir Richard Gregory, president of the association, will open the conference as chairman. Thereafter there will be meetings in four groups, dealing respectively with international intellectual cooperation; natural resources and national needs; social aspects of human nutrition; and scientific discovery and progressive industry. The preliminary program

[1] From *Nature*.

for the conference is taking shape, and already a number of distinguished speakers have consented to participate, if circumstances permit, in the various group-discussions. The program should be ready for issue in the early part of next month. Considerations of finance and the restriction of paper supplies will prohibit its distribution on the usual extensive scale, and any interested persons who do not receive it by the middle of May are requested to ask for it to be sent from the office of the association at Burlington House, London, W.1.

Admission to the conference will be by tickets, the number of which will be restricted to some seven hundred by the available accommodation. The tickets will be free, but members of the association will be urged to maintain their subscriptions, and others will be invited either to become members or to contribute by donation to the funds of the association. Arrangements for the lodging of visitors in the university halls of residence are in hand. The council of the university will hold an informal evening conversazione for members of the association and guests.

## THE AMERICAN STANDARDS ASSOCIATION AND THE U. S. TREASURY DEPARTMENT

FOLLOWING a meeting of the Board of Directors held on May 7 in New York, P. G. Agnew, secretary of the American Standards Association, announced that the U. S. Treasury Department had become a member of the association as the result of official action taken at the meeting.

In proposing affiliation, Herbert E. Gaston, assistant secretary of the treasury, had pointed out that "The work of certain bureaus of this department is such that they have considerable interest in the subject of standardization." The Coast Guard, which operates under the Treasury Department, has a stake in many standardization matters. This interest was materially increased last July when the Bureau of Lighthouses, which had previously operated under the Department of Commerce, long active in American Standards Association affairs, was transferred to its jurisdiction.

The work of the Federal Specifications Executive Committee, which operates under the Procurement Division of the Treasury, is of great importance. This committee coordinates the purchase specifications for items of non-military nature commonly bought by two or more government departments, and seeks to bring these specifications into harmony with the best commercial practices. It also develops new specifications. Its recommendations, with certain exceptions, are mandatory on all departments and independent establishments of the Federal Government.

Membership in the American Standards Association gives the Treasury Department a voice in all decisions on American Standards Association standardization activities. The department has already announced that Captain H. E. Collins, director of procurement of the Procurement Division, and Rear Admiral H. F. Johnson, engineer-in-chief of the U. S. Coast Guard, will serve as its representatives on the council of the association. Captain R. R. Tinkham, also of the Coast Guard, and N. F. Harriman, of the Procurement Division, will serve as their alternates.

At the same meeting the board welcomed two new members: G. J. Ray, vice-president of the Delaware, Lackawanna and Western Railroad, and Wm. F. Groene, vice-president of the R. K. Le Blond Machine Tool Company of Cincinnati. Mr. Ray was nominated in January by the Association of American Railroads and Mr. Groene by the National Machine Tool Builders' Association. Both of these organizations have for many years been active in the work of the American Standards Association.

## THE NATIONAL FARM YOUTH FOUNDATION

HENRY FORD, who has long advocated that American youth return to the soil, has now announced his active cooperation in establishing the National Farm Youth Foundation, which will provide scholarships for twenty thousand young men from the farms. Mr. Ford said:

> Young men of the farm have not realized their opportunities on the home soil. As a result, many of them have left the farm. Young men of the city have not appreciated the career a farm offers. As a result, farming has been neglected.
>
> The family system of farming has suffered and we want to see it rebuilt. As a matter of fact, the foundation seeks to help the young man of the farm to realize his aspirations for happiness and prosperity.
>
> I am told that eighty per cent. of the graduates of agricultural colleges seek their careers in cities instead of returning to the farm. The remaining twenty per cent. are not enough to give the farm the trained leadership it needs for agricultural progress.
>
> Better farming methods to-day will mean better farms to-morrow and rural youth will be more inclined to stay close to the soil.

The opportunity to study scientific farming and receive practical training through scholarships is created by the foundation, which is sponsored by the Ferguson-Sherman Manufacturing Corporation, of Dearborn, Mich., with the active cooperation of Henry Ford and his son Edsel.

In addition to the study courses and training in the field, students under these scholarships will compete for 58 jobs, half of which carry contracts for one year of work at the factory of the sponsoring company at a salary of $150 a month; the remainder are jobs with

the company's distributors, at a salary of $125 a month.

An additional 725 students will be placed on an honor roll and places will be found for them as quickly as possible, with special attention paid to opportunities in their own home communities, where they will best be able to advance the community as well as their own position in it.

The foundation, it is further explained, does not in any way conflict with the work being done by the 4-H Clubs and the Smith-Hughes vocational agricultural high schools, but rather supplements them by affording special training and experience to young men who have already passed the age groups of those organizations.

The scholarships are open to farm youths between the ages of eighteen and twenty-five years.

## MEDICAL FELLOWSHIPS OF THE NATIONAL RESEARCH COUNCIL

THIRTEEN fellowships in the medical sciences, including five renewals, for study in the United States during the year 1940–1941, were awarded at the recent meeting of the Medical Fellowship Board of the National Research Council, Washington, D. C., of which Dr. Francis G. Blake, Sterling professor of medicine, Yale University, is the chairman. A list of the successful candidates and institutions where they are to work follows:

Reginald M. Archibald, Rockefeller Institute for Medical Research.
Frederik B. Bang, Vanderbilt University.
Lindsay E. Beaton, Northwestern University.
Albert H. Coons, Harvard Medical School.
J. Russell Elkinton, Yale University.
Hugh W. Garol, Yale University.
Arden Howell, Jr. (renewal), Duke University.
Carl A. Moyer, Massachusetts General Hospital.
Abe Ravin (renewal), Harvard Medical School.
Joseph Shack (renewal), the Johns Hopkins University.
William M. Wallace (renewal), Harvard Medical School.
Richard J. Winzler (renewal), Cornell University Medical College.
Earl H. Wood, University of Pennsylvania.

## MEDAL DAY OF THE FRANKLIN INSTITUTE

THE annual presentation of the awards of the Franklin Institute of Philadelphia took place on the afternoon of May 15. In the evening a subscription dinner was given in Franklin Hall in honor of the medalists. The program follows:

Presentation of Certificate of Merit, George H. Ernsbarger, Honolulu, and Frank Lee McCarty, Ogden, Utah.

Presentation of Longstreth Medals, Leopold Godowsky, Jr., and Leopold Damrosch Mannes, Eastman Kodak Company; Games Slayter, vice-president, Owens-Corning Fiberglas Corporation, Newark, Ohio; Richard L. Templin, chief engineer of tests, Aluminum Company of America, New Kensington, Pa.; Maxwell Mayhew Upson, president, Raymond Concrete Pile Company, New York City.

Presentation of Wetherill Medals, Laurens Hammond, president, Hammond Instrument Company, Chicago; Edward Ernst Kleinschmidt, president, Kleinschmidt Laboratories, Incorporated, Highland Park, Ill., and Howard L. Krum, Beverly Hills, Calif.

Presentation of Henderson Medal, William E. Woodard, vice-president in charge of design, Lima Locomotive Works, Incorporated, New York City.

Presentation of Levy Medal, Charles Rosenblum, instructor in physical chemistry, Princeton University, and John F. Flagg, instructor in chemistry, University of Rochester.

Presentation of Cresson Medals, Frederick M. Becket, consultant, Union Carbide and Carbon Corporation, New York City, and Robert R. Williams, chemical director, Bell Telephone Laboratories, Incorporated, New York City.

As already announced in SCIENCE, the Franklin Medal and Certificate of Honorary Membership was awarded to Dr. Arthur Holly Compton, of the Ryerson Physical Laboratory of the University of Chicago, who was represented at the ceremonies by his brother, Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, and to Dr. Leo Hendrik Baekeland, president, retired, of the Bakelite Corporation. Addresses were presented by Dr. Compton on "What We Have Learned from Scattered X-Rays" and by Dr. Baekeland on the "Career of a Chemist."

## THE AMERICAN ACADEMY OF ARTS AND SCIENCES

AT the annual meeting of the American Academy of Arts and Sciences, held on May 8, at its House, 28 Newbury Street, Boston, Dr. Clarence C. Little spoke on "Cancer Research and the National Health Problem." The following officers were elected for the year 1940–41:

*President,* Harlow Shapley.
*Vice-president for Class I,* Percy W. Bridgman.
*Vice-president for Class II,* S. Burt Wolbach.
*Vice-president for Class III,* Sidney B. Fay.
*Vice-president for Class IV,* Arthur S. Pease.
*Corresponding Secretary,* Abbott P. Usher.
*Recording Secretary,* Hudson Hoagland.
*Treasurer,* Horace S. Ford.
*Librarian,* Hervey W. Shimer.
*Editor,* Robert P. Blake.
*For Councilors for Four Years:* Arthur A. Blanchard, of Class I; William B. Castle, of Class II; Henry P. Kendall, of Class III; Charles H. Taylor, of Class IV.
*For Councilor for Three Years:* Arthur N. Holcombe, of Class III.
*For Councilor for Two Years:* Austin W. Scott, of Class III.

*For Committee on Policy and Resources: For Five Years:* Tenney L. Davis.

*For Committee on Meetings:* The President; The Recording Secretary; Dugald C. Jackson; Tenney L. Davis; Abbott P. Usher and Samuel H. Cross.

The following new fellows in the scientific classes were elected:

*Mathematical and Physical Sciences:*

William Lloyd Evans, the Ohio State University.

Harold Locke Hazen, the Massachusetts Institute of Technology.

Frederick Vinton Hunt, Harvard University.

J. Robert Oppenheimer, the University of California.

John Wulff, the Massachusetts Institute of Technology.

*Natural and Physiological Sciences:*

Albert Francis Blakeslee, Carnegie Institution Station for Experimental Evolution.

William de Berniere MacNider, the University of North Carolina.

Paul Christoph Mangelsdorf, Texas Agricultural and Mechanical College.

Donald Dexter Van Slyke, the Rockefeller Institute.

Paul Dudley White, Massachusetts General Hospital.

## THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the American Philosophical Society was held in the Hall of the Society on Independence Square, Philadelphia, on April 18, 19 and 20. There was a large attendance of members of the society and invited guests and in three of the half-day sessions twenty-one papers were read on subjects as varied as astronomy, archeology, biology, ethnology, paleontology, physiology, psychology, classics, history, literature and art. An unusual feature of this meeting was a symposium on "Characteristics of American Culture." This symposium was organized by Dr. Frederick P. Keppel, president of the Carnegie Corporation of New York, and various aspects of this general theme were presented by Frederick L. Allen, associate editor of *Harpers Magazine;* Alfred V. Kidder, of the Carnegie Institution of Washington; Lewis Mumford and Van Wyck Brooks, well-known authors; Francis Taylor, director of the Metropolitan Museum of Art, Otto Luening, professor of music, Bennington College, and Arthur H. Compton, of the University of Chicago. This symposium was a brilliant success as measured by the excellence of the papers presented and the enthusiasm of the large audience in attendance.

The lectures on Thursday and Friday evenings were equally notable; the former by Dayton C. Miller, of the Case School of Applied Science, on "The Pipes of Pan, Old and New," with many demonstrations drawn from his unique collection of flutes, was a striking presentation of the history, science and art of the flute. The Penrose Memorial Lecture on Friday evening by Archibald MacLeish, librarian of Congress, was a challenging and inspiring address on the obligation of "Writers and Scholars" to maintain our basic liberties in an age of increasing illiberalism and despotism.

The social features of this meeting were especially attractive; in addition to the usual luncheons and receptions in the hall of the society, many of the members of the society and their guests were invited by Mr. Joseph E. Widener to visit his famous art gallery on Saturday afternoon; others were invited by Dr. V. K. Zworykin to see his new electron microscope at the R.C.A. Building in Camden; and a reception was given by President and Mrs. Thomas S. Gates, of the University of Pennsylvania, at their Chestnut Hill home.

At the annual dinner on Saturday evening the John F. Lewis Prize of $300 and a diploma was presented to Dr. Earle Radcliffe Caley for his excellent communication and publication on "The Composition of Ancient Greek Bronze Coins." The citation was given by Dr. Benjamin D. Meritt, of the Institute for Advanced Study, and the presentation was made by Roland S. Morris, president of the society. Other after-dinner addresses were made by Dr. Philip C. Jessup on "Neutrality To-day"; by Dr. A. V. Hill, secretary of the Royal Society, on "Internationalism in Science," and by President Thomas S. Gates on "The Two Hundredth Anniversary of the University of Pennsylvania."

At the annual business meeting the following officers were elected:

*President,* Roland S. Morris.

*Vice-presidents,* Edwin G. Conklin, Robert A. Millikan, William E. Lingelbach.

*Secretaries,* John A. Miller, W. F. G. Swann.

*Curator,* Albert P. Brubaker.

*Treasurer,* Fidelity-Philadelphia Trust Company.

*Councilors* to serve until 1943, Harlow Shapley, Detlev W. Bronk, Nathan Hayward, Frederick P. Keppel.

The following thirty resident and eight foreign members were elected:

*Class I. Mathematical and Physical Sciences:* Ira Sprague Bowen, Pasadena; William Francis Giauque, Berkeley; Jerome Clarke Hunsaker, Boston; George Bogdan Kistiakowsky, Cambridge; Robert Sanderson Mulliken, Chicago; Howard Percy Robertson, Princeton; John Clarke Slater, Cambridge. *Foreign:* Niels Henrik David Bohr, Copenhagen; Sir William Henry Bragg, London; Tullio Levi-Civita, Rome.

*Class II. Geological and Biological Sciences:* George Washington Corner, Baltimore; Samuel Randall Detwiler, New York; Eugene Floyd DuBois, New York; Frederick Lee Hisaw, Cambridge; Esmond Ray Long, Philadelphia; Elvin Charles Stakman, St. Paul; Wendell Meredith Stanley, Princeton. *Foreign:* Pierre Janet, Paris.

*Class III. Social Sciences:* Hamilton Fish Armstrong New York; Joseph Perkins Chamberlain, New York; John Dickinson, Philadelphia; Morris Duane, Philadelphia; Carlton Joseph Huntley Hayes, New York; Morris E. Leeds, Philadelphia; William Fielding Ogburn, Chicago;

Roscoe Pound, Watertown, Mass.; Adolph G. Rosengarten, Philadelphia. *Foreign:* Eli Filip Heckscher, Stockholm; Lord Stamp, London.

*Class IV. Humanities:* Joseph Quincy Adams, Washington; Charles Henry Beeson, Chicago; Charles Burton Gulick, Cambridge; Frank Jewett Mather, Jr., Princeton; Sylvanus Griswold Morley, Santa Fe; Arthur Hobson Quinn, Philadelphia; George Andrew Reisner, Boston. *Foreign:* Franz Valery Marie Cumont, Rome; Ramón Menéndez Pidal, Madrid.

# SCIENTIFIC NOTES AND NEWS

THE eighth American Scientific Congress is now in session. The formal inaugural meeting was held in Constitution Hall, Washington, D. C., on the evening of May 10, when an address of welcome was made by the President of the United States. The first plenary session was held in the Pan American Building on Monday morning with an address of welcome by the Honorable Cordell Hull, Secretary of State, and responses on behalf of the delegations. Section meetings are being held on May 13, 14, 15, 16 and 17, at which about six hundred papers are being presented. There are present about three hundred delegates from Latin America and about twelve hundred from the United States. SCIENCE will print a full account of the proceedings of the congress.

AT the annual meeting in Atlantic City of the American Association of American Physicians, the George M. Kober Medal for 1940 was presented to Dr. F. F. Russell, professor of preventive medicine and epidemiology at the Harvard Medical School and the School of Public Health, in recognition of his development of double-sugar media for cultivated typhoid bacilli. The medal for 1941 was awarded to Dr. William de Berniere MacNider, dean of the School of Medicine of the University of North Carolina, for the development of acquired resistance of fixed tissue cells after injury on the part of the liver and kidney.

THE Franklin L. Burr prizes of $1,000 each of the National Geographic Society have been awarded to Matthew W. Stirling, chief of the Bureau of Ethnology of the Smithsonian Institution, and to Bradford Washburn, of Cambridge, Mass. The award to Mr. Stirling is in recognition of his work in the field of archeology, especially his discovery in 1939, in the State of Vera Cruz, Mexico, of a monument bearing the earliest recorded date yet discovered in the new world—a date in Maya symbols corresponding to 291 B. C. of the Christian calendar, and the uncovering of other carvings and artifacts shedding light on early civilization in Mexico. Mr. Washburn received the prize for his explorations by air and for his aerial photography during the last three years of glaciers and parts of glacier systems not previously known to exist in Alaska near Mount St. Elias.

THE Friedsam Medal of the Architectural League of New York, awarded annually to a "person who has contributed conspicuously to the advancement of American art" was presented at a dinner on May 9 to Dr. Frederick P. Keppel, president of the Carnegie Corporation of New York. The citation reads: "Educator and educational administrator, sympathetic guide and thoughtful adviser of students; understanding director of educational institutions; author of important works on the place of art in public life and the sociological significance of art in the growth of the nation—with power and wisdom bringing to art and to artists, to the learning as to the learned, active aid and enduring encouragement—wise dispenser of great fortune, seeking its greatness in the service to art and with practiced hand assuring by that service, in its simplicity and directness, an effective enhancement of American art."

THE Boston Society of Natural History has awarded the first Walker Prize in Natural History to William Parrish for a paper on the "Reflectance of Opaque Minerals," and the second prize to John T. Hack for an account of the "Sand Dunes of the Western Navajo Country." Honorable mention was made of a paper on the "Radioactivity of Terrestrial Material" by Clark Goodman.

THE Howard Taylor Ricketts Prize of the University of Chicago has been awarded to Dr. Harold R. Reames, formerly a student of Dr. Francis B. Gordon in the department of bacteriology and parasitology, now a member of the department of pathology at Washington University, St. Louis. The prize is given in recognition of research on "local virus infection of the upper respiratory tract which provides immunity upon subsequent exposure." The Ricketts Prize, which this year amounted to $190, was established in 1913 to honor Dr. Howard Taylor Ricketts, of the University of Chicago, who discovered the typhus germ and who died a martyr to his discovery in Mexico.

AT a recent meeting of the Council of the Royal College of Surgeons of England the John Hunter Medal and the Triennial Prize were presented to Colonel L. E. H. Whitby, and the Jacksonian Prize for the year 1939 was awarded to F. F. Rundle for his essay on "The Pathology and Treatment of Thyrotoxicosis"; a Certificate of Honorable Mention was awarded to N. M. Harry, of Melbourne, for an essay on the same subject. The following subject was approved for the Jacksonian

Prize for the year 1941: "Injuries to Peripheral Nerves, with Especial Reference to the Late After Results."

THE Académie de Médecine, Paris, has awarded the Helme Prize to Dr. André Gratia, professor of bacteriology at Liége University, for his work on bacteriophages.

DR. LEONARD J. PICCOLI, professor and head of the department of pharmacology and director of the Public Health Laboratories of the College of Pharmacy of Fordham University, was elected president of the Alumni Association of the Institute of Public Health of the College of Physicians and Surgeons at the annual dinner meeting of the association, held in the Hotel George Washington on May 2. This meeting was held in honor of the founder and retiring director of the Institute of Public Health, Dr. Haven Emerson, formerly Commissioner of Health in New York City.

DR. LOUIS HAMMAN, professor of clinical medicine at the Johns Hopkins University, was elected president of the Association of American Physicians at the Atlantic City meeting to succeed Dr. Gerald B. Webb, of Colorado Springs. Dr. J. H. Means, of Boston, was elected vice-president.

DR. DAVID CHEEVER, associate professor of surgery in the Harvard Medical School, was elected president of the American Surgical Association at the recent meeting at Washington University, St. Louis. Dr. Howard C. Naffziger, of San Francisco, and Dr. Roscoe R. Graham, of Toronto, were elected vice-presidents. Next year's convention will be in White Sulphur Springs, W. Va.

DR. ROBERT CALVERT, chief chemist of the Johns-Manville Corporation, was elected chairman of the New York Section of the American Chemical Society at its annual meeting held in New York City on May 3. Dr. Ralph H. Muller, of New York University, was named chairman-elect.

*Nature* states that at the recent annual general meeting of the Institute of Metals, held in London, the following officers were elected: *President,* Lieutenant-Colonel the Hon. R. M. Preston; *Vice-presidents,* Dr. S. F. Dorey, Engineer Vice-Admiral Sir George Preece and A. J. G. Smout; *Treasurer,* Lieutenant-General Sir Ronald Charles; *New Members of Council,* Dr. W. E. Alkins, G. L. Bailey, Captain F. C. Braby, Colonel P. G. J. Gueterbock and Professor D. Hanson.

RECENT appointments to the staff of the Agricultural Experiment Station of Purdue University include Dr. Frederick N. Andrews, of the department of animal husbandry of the University of Missouri, and Dr. Ralph E. Lincoln, national research fellow at Cornell University. Dr. Andrews will have charge of the investigations in reproductive physiology in animals; Dr. Lincoln will have charge of investigations on breeding for resistance to disease in vegetable crops.

THE title of emeritus professor of chemistry will be conferred by the Massachusetts State College on Dr. Joseph S. Chamberlain when he retires in June. Dr. Chamberlain is now Goessmann professor of chemistry.

PROFESSOR H. MARSHALL CHADWELL has been appointed chairman of the department of chemistry and chemical engineering of Tufts College. Professor Crosby F. Baker has been appointed secretary and curator of the Pearson Memorial Laboratory, and Professor David E. Worrall, director of the Chemical Laboratory.

DR. JAMES M. CHURCH, research chemist in the Technical Service Division of the Monsanto Chemical Company, St. Louis, has been appointed assistant professor of chemical engineering at Columbia University.

DR. H. H. SHELDON, professor of physics at New York University, which he has served for the past eighteen years, recently in charge of the adult education courses in science, has resigned. He plans to open a consulting service in New York City. Dr. Sheldon is secretary of the Board of Management of the Engineers Club of New York, and has been retained in the past by various industrial organizations. He was for four years science editor of the *New York Herald-Tribune.* Dr. Sheldon expects to continue as managing trustee of the American Institute of the City of New York, whose work he has directed for the past two years.

A NEW Department of Light has been formed at the British National Physical Laboratory to comprise the former optics division of the department of physics and the division of photometry of the department of electricity. T. Smith has been appointed superintendent of the new department as from April 1. Dr. E. H. Rayner retired from the post of superintendent of the department of electricity on March 31, having attained the normal age limit. He has been succeeded by R. S. J. Spilsbury, formerly principal scientific officer in the department.

DR. CHARLES E. MCLENNAN, of the department of obstetrics and gynecology of the University of Minnesota Medical School, has been awarded a fellowship by the Commonwealth Fund, for a year's study with Dr. E. M. Landis, of the University of Virginia on problems concerning the toxemias of pregnancy.

ALFRED P. SLOAN fellowships in traffic engineering,

each carrying a stipend of $1,400, have been awarded by Yale University to the following engineers of highway departments, who wish to specialize in traffic control: Douglas Bowers, Oklahoma Highway Department; Bernard C. Hartung, director of traffic and safety division of the Nevada Highway Department; Henry Osborne, traffic engineer, Flint, Mich.; H. L. Slover, traffic engineer for Memphis; Francis E. Twiss, State Department of Engineering, Hartford, Conn., and H. T. Sorensen, National Safety Council.

AT the University of Michigan leaves of absence for the college year 1940–1941 have been given to Professor Thomas S. Lovering, of the department of geology; to Professor Raymond L. Wilder, of the department of mathematics, and to Professor Stanley D. Dodge, of the department of geography. Leave has been granted for the first semester to Professor Louis C. Karpinski, of the department of mathematics; to Professor Walter B. Pillsbury, of the department of psychology; to Professor Alfred H. Stockard, of the department of zoology, and to Professor Lars Thomassen, of the department of chemical and metallurgical engineering.

CONTINUING its program of exploration of the islands of Oceania, the B. P. Bishop Museum, Honolulu, will send O. H. Swezey, consulting entomologist, and Elwood C. Zimmerman, staff entomologist, to American and British Samoa on May 27. The party will be in the field for at least three months. Mr. Swezey will specialize in rearing Microlepidoptera and making studies of their host plant relationships. Mr. Zimmerman will continue his studies in zoogeography and make a comprehensive collection of insects and other arthropods and terrestrial Mollusca.

DR. CLARENCE COOK LITTLE, director of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Maine, and managing director of the American Society for the Control of Cancer, spoke on May 8 on cancer research and the national health problem before the American Academy of Arts and Sciences, Boston.

JAMES A. BERRY, of the Frozen Pack Laboratory of the U. S. Department of Agriculture at Seattle, Wash., delivered on April 17 the annual address before the Society of the Sigma Xi at the Kansas State College. He spoke on "Scientific Basis of Frozen Food Technology."

DR. HAROLD E. EDGERTON, associate professor of electrical measurements at the Massachusetts Institute of Technology, delivered the annual initiation lecture of the University of Cincinnati Section of Sigma Xi on May 11. The title of the lecture was "Seeing the Unseen with High-Speed Photography."

IN the issue of SCIENCE for February 2 the registration at the Columbus meeting of the American Association is listed by states and countries. In this list, Hawaii, the Philippines and Puerto Rico were inadvertently placed under foreign countries.

DEDICATION of the McGregor Building and the seventy-foot tower telescope, the gift of the McGregor Fund of the University of Michigan to the McMath-Hulbert Observatory, Lake Angelus, Pontiac, Mich., will take place on May 25, when the program will be as follows: Presentation of the McGregor Building to the University of Michigan, the Hon. Henry S. Hulbert, president of the McGregor Fund; acceptance for the University of Michigan by President Alexander G. Ruthven; and for the McMath-Hulbert Observatory by the director, Dr. Robert R. McMath, and by Dr. Heber D. Curtis, director of the observatories of the University of Michigan. The principal address, "Frontiers of Research," will be made by Dr. Charles Franklin Kettering, president of the General Motors Research Corporation.

THE Food Research Laboratories, Inc., of New York City, which were organized in 1922 by Dr. Philip B. Hawk, the president of the organization, have removed from 114 East 32nd Street to their newly constructed laboratory building at 48–14 33d Street, Long Island City, N. Y. Dr. Bernard L. Oser is vice-president and director of the laboratories, with which he has been associated since 1926. This is the second expansion of the organization since its inception in 1922. The new building is situated in a readily accessible section of Long Island City. In the immediate vicinity are the plants of well-known manufacturers. The library and conference room occupies a prominent position in the front of the building. Private offices for members of the administrative staff and a general office and reception room are included. In the early part of May, the Food Research Laboratories held a series of receptions to invited guests, and visitors will now be welcomed at all times.

A NEW building for the State Laboratory of Hygiene, erected at the cost of $200,000, was dedicated recently in Raleigh, N. C., in memory of the late Dr. Clarence A. Shore, who organized the laboratory and directed it from 1908 to 1933. Speakers at the ceremony included Governor Hoey; Drs. John A. Ferrell, New York, associate director of the International Health Division of the Rockefeller Foundation; Sylvester D. Craig, Winston-Salem, president of the State Board of Health; John H. Hamilton, present director of the laboratory; Carl V. Reynolds, state health officer, and George M. Cooper, director of the Division of Preventive Medicine of the State Department of Health.

THE Eastern Section of the Seismological Society

of America will hold its fifteenth annual meeting on May 31 and June 1 at Xavier University, Cincinnati. The chairman of the section is Professor Arthur C. Ruge, of the Massachusetts Institute of Technology, and the secretary is Professor William A. Lynch, of Fordham University.

THE tenth annual summer Research Conference of the Johns Hopkins University will be held at the Henlopen Hotel, Rehoboth Beach, Delaware, from June 3 to 7 and 10 to 14. The first week will be devoted to various aspects of biocatalysis; the second to some fundamental topics concerning organic reactions. The conference affords an opportunity for a group of specialists to discuss informally various fundamental topics in biochemistry and in organic chemistry. The attendance is kept sufficiently small to allow all present to participate in the discussions. The schedule of the various sessions is so arranged as to leave time for taking advantage of the many recreational facilities, including surf bathing, golf, fishing, boating and tennis. Further information may be obtained from P. H. Emmett, The Johns Hopkins University, Baltimore, Md.

# DISCUSSION

## COLOR EFFECTS OBSERVABLE FROM FLUORESCENT LAMPS

IN the April 12 number of SCIENCE for this year, page 357, Scull, Grosscup and Witting draw attention to an "Apparent Splitting of Light from Fluorescent Lamps into Component Parts by Moving Objects." When for instance a wire which had been made to vibrate by a magnetic field produced by 60 cycle current, was illuminated by a "daylight" fluorescent lamp operated also on 60 cycle, they observed two images of the wire, one red and the other blue. This effect and other similar ones they ascribed to the possibility that there are differences in the time intervals of emission of light of various wave lengths from the lamp.

This suggestion is close to an explanation based on observations of the emissive characteristics of phosphors. The fluorescent lamp utilizes a low pressure mercury discharge to excite fluorescence from phosphors coated upon the walls of the bulb.[1] For "daylight" radiation, a mixture of various phosphors is used, each contributing fluorescence of a different color and covering such a spectral range that their combined emission overlaps to give a fairly smooth curve throughout the range of visible light. This curve, however, represents purely their predominant fluorescent emission. At specific points in the cycle of a-c operation, distinctive colors are observable, due to peculiarities in the emissive characteristics of the individual phosphors present in the lamp. Phosphors in general exhibit two types of emission. The first occurs during the period of excitation and the light emitted can be termed fluorescence. When the source of excitation is removed, there is a continued emission of light, but this is of the second type termed phosphorescence. It is characterized by widely different rates of decay depending upon the phosphor involved. Fonda[2] and Johnson and Davis[3] have measured these rates for some typical phosphors and have found that there is a corresponding variation in the rate of pick-up of fluorescence during the period of excitation. A phosphor for instance which shows a slow decay in its phosphorescence shows a correspondingly retarded development of its fluorescence. Another phosphor, characterized by such a rapid decay that its phosphorescence is negligible, is capable of immediate, full response to the exciting light.

In the case cited of the vibrating wire illuminated by the radiation from a mixture of phosphors present in the "daylight" lamp, the blue image would have the color of fluorescence emitted by the phosphor whose response to excitation was most rapid. It would correspond to a point of rising potential in the a-c cycle. The red image on the other hand would be that observable at zero potential and would be produced by the phosphorescence from the phosphor having the slowest rate of decay. These two phosphors when examined separately would be found to fluoresce respectively near the blue end of the spectrum and near the red end.

The other effects noted by the authors can be explained similarly.

GORTON R. FONDA

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[1] Inman and Thayer, *Elec. Eng.*, 57: 245, 1938.

[2] Fonda, *Jour. Applied Phys.*, 10: 408, 1939.

[3] Johnson and Davis, *Jour. Optical Soc. Amer.*, 29: 283, 1939.

## MERCURY POISONING

MOST experimental scientists have become so accustomed to handling mercury in calibrations, manometers, pumps, etc., that they no longer think of it as a poison, yet under certain circumstances mercury may become a source of serious chronic illness. Vaporization of mercury occurs rapidly at room temperatures and one cubic meter of air saturated with mercury vapor at 25° C. contains 19.5 mg of mercury. When a stream of air passes at the rate of one liter per minute over a 10 cm² surface of mercury at 25° C. it becomes about 15 per cent. saturated,[1] containing ap-

[1] P. A. Leighton, private communication, "Concerning Mercury Vapor."

proximately 3 mg of mercury per cubic meter. This much mercury may accumulate in the air of a closed laboratory where numerous droplets of mercury, spattered during the course of manipulations, are present in cracks in the floor and furniture and where open vessels of mercury are kept. Prolonged exposure of some individuals to as little as 0.01 mg of mercury per cubic meter of air[2] and of many individuals to 0.25 mg[3, 4] results in chronic mercury poisoning. Although the content of mercury in the air inhaled is low, a portion of the mercury is retained,[3] and, since air is inhaled at the rate of approximately a cubic meter per hour and the mercury is only slowly voided, the amount in the body soon accumulates beyond tolerance limits.

The biographies of some famous physicists and chemists, such as Faraday and Pascal, show that they were sufferers from chronic mercury poisoning without being aware of the nature of their illness.[2] Victims of mercury poisoning show, among other symptoms, irritability, headaches, catarrhal troubles and recession of the gums. These symptoms may not develop until several months after the exposure and may persist for years.

Small amounts of mercury in the dust of laboratories where mercury has been handled may be detected in a number of ways[5] and may be demonstrated visually by the use of a mercury resonance lamp and a screen of anthracene.[6] The sweepings from such a laboratory are placed in a beaker and warmed and the beaker is then interposed between the source of light and the screen; since the light is mainly of λ2537A and this wave-length is strongly absorbed by the mercury vapor, one can actually "see" the vapor rising from the beaker.[6] If the resonance absorption of mercury were in the visible instead of the ultra-violet, the indifference with which many laboratory workers treat mercury would be replaced by extreme care.

Certain precautions will readily insure one against mercury poisoning: (1) All containers with mercury should be tightly covered. (2) Mercury should always be handled in a container to catch spattered droplets. A satisfactory container is easily made by bending in the edges of a sheet of wrapping paper and fastening the corners with paper clips. On completing manipulations droplets of mercury on glassware used may be easily brushed off with a feather. The stray mercury may be returned to the stock by inclining the paper container and puncturing the corner over the stock bottle. (3) If a room has been previously contaminated with mercury, all cracks should be cleaned by means of a suction pump with trap and tube and the laboratory should be well ventilated each time before use. This is especially urgent if the room has no windows and if the temperature is relatively high. (4) Finally, one should avoid getting mercury onto his clothes and skin and should thoroughly wash his hands, including the nails, after handling mercury. This note merely calls attention to the necessity for precautions in handling mercury; for discussion of mercury poisoning the reader is referred to Goodman[5] and the literature cited by him.

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[2] Stock, *Zeits. angew. Chemie*, 39: 461, 1926; 42: 999, 1929.
[3] Fraser, Melville and Stehle, *Jour. Ind. Hyg.*, 16: 77, 1934.
[4] *U. S. Publ. Health Service Bull.* 234, 1937.
[5] Goodman, *Rev. Sci. Instr.*, 9: 233, 1938.
[6] Leighton and Leighton, *Jour. Chem. Educ.*, 12: 139, 1935.

## IS SULFANILAMIDE BACTERIOSTATIC UNDER "ANAEROBIC" CONDITIONS?

RECENTLY R. H. Broh-Kahn[1] presented data which he interpreted as demonstrating "the bacteriostatic action of sulfanilamide under anaerobic conditions." Utilizing a medium of inorganic salts and lactate devised by Quastel, Stephenson and Whetham,[2] Broh-Kahn observed no bacteriostasis with sulfanilamide under aerobic conditions. When air was completely excluded, however, bacteriostasis could be demonstrated by the addition of nitrate to this medium.

At first glance, this would seem to demonstrate bacteriostasis by sulfanilamide under anaerobic conditions. Nevertheless, as Quastel, Stephenson and Whetham explicitly state, *E. coli* cultivated with lactate and nitrate in the absence of air actually grows aerobically, the lactate being oxidized by the nitrate which is reduced to nitrite. "It is generally accepted to-day that the biological significance of the reduction of nitrate is that by it oxygen is supplied to an organism when free oxygen is no longer available." Furthermore, when one applies the reduction of methylene blue as a criterion of anaerobiosis, Broh-Kahn's data will be seen to support the view that anaerobic, reducing conditions interfere with sulfanilamide bacteriostasis.[3, 4] Applying this test to the conditions used by Broh-Kahn, methylene blue was introduced, either initially or after growth had occurred, into cultures of *E. coli* in the media of Quastel *et al.* In Table I are summarized the results of these experiments together with the data reported by Broh-Kahn.

The table shows clearly, as pointed out by Quastel, Stephenson and Whetham, that in the simple lactate medium reducing conditions prevail. Here sulfanilamide has no effect. In the "anaerobic" lactate-nitrate medium in which the methylene blue remains unre-

[1] R. H. Broh-Kahn, SCIENCE, 90: 543, 1939.
[2] J. H. Quastel, M. Stephenson and M. Whetham, *Biochem. Jour.*, 19: 304, 1925.
[3] C. L. Fox, Jr., B. German and C. A. Janeway, *Proc. Soc. Exp. Biol. Med.*, 40: 184, 1939.
[4] C. L. Fox, Jr., *Am. Jour. Med. Sci.*, 199: 487–494, 1940.

TABLE I

| | Medium | Results obtained by Broh-Kahn in sulfanilamide culture | Results obtained in culture containing methylene blue (no sulfanilamide present) |
|---|---|---|---|
| Aerobic | lactate | No bacteriostasis | complete reduction |
| Anaerobic | lactate | Good bacteriostasis | no reduction |
| | + nitrate | | (nitrite formed) |

duced the bacteriostatic action of sulfanilamide is clearly manifest.

The unsatisfactory effect of sulfanilamide therapy of closed space infections, empyema, and mastoiditis may be explained by correlating the above data with the demonstration by Menkin[5] that similar experimental infections are accompanied by anaerobic glycolysis, the extent of which depends upon the severity of the induced infection.

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## AN ILLUSTRATED CATALOGUE OF MESOZOIC AND EARLY CENOZOIC PLANTS OF NORTH AMERICA

THE accurate identification of fossils is considerably facilitated by the use of illustrated card catalogues. Up to the present no such catalogue of fossil plants is known to exist in this country. During the past three years the writer has compiled a catalogue containing the figures and descriptions of all plant species of the Mesozoic and Paleocene of North America. It is hoped that the compilation may gradually be enlarged to include the remaining Cenozoic species of North America and at least the holotypes of foreign species of both the Mesozoic and Cenozoic.

In compiling the catalogue duplicate copies of all available publications on Mesozoic and early Cenozoic plants were first secured by purchase. To date, 46 monographs and over 80 shorter reports have been utilized. From each of these the figures and descriptions of species were cut out and pasted on the front and reverse sides, respectively, of specially printed 8 by 10 inch cards. In addition to the figure the front of each card contains the following: the original name of the species and its founder, the formation in which the specimen was found, the geologic system to which the formation belongs, the kind of type specimen represented, the name, date and author of the publication from which the figure and description were clipped and the subsequent changes in name and synonymy of the species. The back of each card contains the description and precise locality of each figured specimen.

[5] Valy Menkin and C. R. Warner, *Am. Jour. Path.*, 13: 25, 1937.

If duplicate copies of publications were not available for clipping, the figures of species were photographed and the descriptions transcribed from library copies. The catalogue is kept up to date by clipping new publications as soon as duplicates can be obtained.

For both convenience and efficiency the catalogue of over 4,500 cards has been separated systematically into numerous small groups, each of which contains species of generally similar characteristics. In the case of dicotyledonous leaves, for example, well-defined differences in shape, venation and marginal characters are the principal bases of separation into 52 distinct groups. An artificial key, with line drawings and short descriptions of each group, accompanies the catalogue. By means of the key a specimen to be identified is easily and quickly referred to a particular group. An examination of the cards of a particular group (generally not over 50 in number) shows whether or not the specimen can be identified as a previously described species.

The catalogue has demonstrated its usefulness in several ways: (1) the time required for the identification of a specimen has been reduced from the previous 6 to 8 hours by the usual haphazard methods to about 30 minutes by the use of the catalogue; (2) for age determinations each small group of cards contains relevant stratigraphic information about both identical and related species; (3) for taxonomic studies it is advantageous to have in the easily handled, compact groups of cards the figures of numerous specimens of generally similar characters, as well as the discussions of various authors regarding botanical affinities; (4) for studies of modern plants it may quickly be determined whether or not a certain type of leaf or seed is represented by similar or comparable forms in the Mesozoic or early Cenozoic.

For added efficiency it is planned to accompany the catalogue by three cross-indices: stratigraphic, systematic and alphabetic.

Financial and clerical assistance for the undertaking has been given by the department of geology of Princeton University. For their careful work the writer is indebted to Mrs. C. Tindall, Miss H. Hurley, Miss C. D. Gurnsey, Mrs. J. A. Lahey, Mr. K. M. Waagé and Mr. H. deN. Wynne.

The completed catalogue may be consulted in the department of geology, Princeton University.

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## THE PEACE RESOLUTION OF SCIENTIFIC WORKERS

IN the Peace Resolution of the American Association of Scientific Workers printed in SCIENCE of May 3 much is said to which every scientist can assent.

This is notably true of the statement, "the continuance of progress now largely depends upon the scientists of the neutral nations." But then follows the sentence "American scientists can best fulfill their share of this responsibility if the United States remains at peace." Is this not a categorical conclusion based upon premises which are still in the making? Should scientists endorse *as scientists* a conclusion reached in this way, thus responding to the attempt to "crystallize their attitudes toward the conflict" while all is yet in flux?

I venture to raise this question because of the plan to present the peace resolution to the President of the United States as representing the view of American scientists generally.

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# THE NATIONAL ACADEMY OF SCIENCES

## ABSTRACTS OF PAPERS

(*Continued from p. 457*)

*A method for finding certain types of definite integrals:* H. BATEMAN. The method devised by Poisson and Lerch for finding an integral $I(t)$ which exists for $R(t) > 0$ is to first calculate the Laplacian integral whose integrand is $I(t)\ exp\ (-xt)dt$. The corresponding method in which the integrand is $I(t)t^z\,dt$ is based on the theory of the Mellin inversion formula, but in using it in practice to obtain effective expressions for $I(t)$ it is advantageous to employ theorems, analogous to Laurent's theorem, for the representation of a function analytic in a strip in a series of rational functions instead of a series of powers of $x$. Examples of such representations are given.

*Solar faculae and solar constant variations:* HENRYK ARCTOWSKI (introduced by C. G. Abbot). The daily solar constant values, for the years 1926–1930, have been compared with the areas of faculae in order to search for the direct correlation between solar phenomena and the variations of solar radiation advocated by Dr. Abbot. The solar constant data have been taken from volume 5 of the Annals of the Astrophysical Observatory of the Smithsonian Institution and those of the areas of faculae from the results of measures made at the Royal Observatory, Greenwich, of photographs of the sun taken at Greenwich, at the Cape and in India. It has been found that the mean values for the days of maxima and minima of the solar constant and the five days preceding and following these days give curves similar to those of the faculae of the same dates. The mean maximum as well as the mean minimum of the solar constant variation, however, are slightly in advance of those of the faculae.

*Irregularities of absorption in the galaxy:* JOEL STEBBINS, C. M. HUFFER and A. E. WHITFORD. In continuation of work previously reported to the Academy the absorption in the galaxy has been derived from measured colors of stars known to be intrinsically white but which are reddened by the effect of dark material in the spaces between the stars. While in general the interstellar dust is concentrated in a thin layer near the main plane of the galaxy, much like the ham in a sandwich, there are many irregularities in its distribution. The layer is of unequal thickness in different directions, being more dense toward the center than toward the anti-center of the system, and there are numerous detached clouds of dust with clear spaces between them and the main absorbing layer. Toward the center where the absorption is greatest, a clear region has been detected extending to 3,000 light-years from the sun, while not far away are dark clouds nearer than 1,000 light-years. However, there is small chance of penetrating through to the galactic center at 30,000 light-years. As the estimated dimensions of our own galaxy and the distances to other galaxies depend upon proper allowance for the absorption of interstellar dust, the irregularity of this absorption complicates such estimates more than has been hitherto realized.

*Perceived size of the moon as a function of angle of regard:* EDWIN G. BORING and ALFRED H. HOLWAY. The perceived diameter of the moon at the horizon is from one and one half to two times the perceived diameter in culmination. The usual explanation of the moon illusion is that the horizon appears more distant than the zenith, although the moon continues to subtend the same visual angle at every elevation, so that the ascending moon, appearing to approach the observer without increase in the size of its retinal image, must seem as an object to get smaller. This theory, which refers perceived size to perceived distance, provides no explanation of the variation of the perception of distance with the elevation of the observed object. It is known further that the illusion holds for objects more than 30 m distant, but is greatly diminished as the radius of observation is decreased below 30 m. We have shown that the perceived size of the moon decreases with its elevation from the primary position of regard. In this function the elevation of the moon is relative to the head of the observer and not to his body or to the earth. Thus for the supine observer the horizon moon is smallest and the moon in elevation largest. The perceived size diminishes when the head is kept fixed and only the eyes are elevated. It does not change when the head is tilted back so that the eyes are not moved with respect to the head. The direction of change of perceived size is reversed below the primary position. To the erect observer the moon below the horizon, if it could be visible, would appear about as much smaller, angle for angle, when compared with the horizon moon, as the moon in elevation seems smaller. The same form of function is found for the sun when two mirrored images of it are compared through dark filters. The general rule is that objects at a great distance appear largest when the eyes are in the primary position with respect to the head, irrespective of the position of the observer's head and body. No final explanation of the moon illusion can be formulated at present, but these results are more consistent with an explanation in terms of relative torsion of

the two eyes than with the older explanation which referred the illusion to compensatory ocular convergence.

*The chemical separation of isotopes:* HAROLD C. UREY. The chemical separation of the isotopes of nitrogen and carbon gives the most rapid separation of these isotopes which has so far been devised. Experiments have been made in which 0.75 gram of $N^{15}$ and 0.15 gram of $C^{13}$ have been transported per 24-hour period. The simple process fractionation factor for the exchange reaction between ammonium ion and ammonia is 0.967, favoring the concentration of $N^{15}$ in the ammonium ion, while the simple process factor for the exchange reaction between hydrogen cyanide and cyanide ion is 1.025, favoring the concentration of $C^{13}$ in the gas. These rates of production are for laboratory production. There seems to be no reason why the method can not be extended to plant size apparatus with the production on as large a scale as is required.

*Corrosion resistant alloys:* H. H. UHLIG and JOHN WULFF (introduced by Karl T. Compton). Various solid solution alloys of the transition and pre-transition group elements have wide application due to their corrosion resistance. This is attributed to their passivity which is usually explained on the basis of an impervious oxide film. Electrochemical, threshold potential and corrosion data are not explained in simple terms on this viewpoint. A consideration of such data for Fe-Cr, Fe-Ni and Cu-Ni alloys shows that corrosion resistance begins at critical alloy compositions; thus, atomic ratios of five Fe atoms to one Cr or two Fe to one Ni are sufficient to induce passivity. This may be attributed to the ability of Cr in the Fe-Cr system to provide sharing possibilities for five electrons of the five nearest Fe neighbors, based on the assumption that Fe with one shared electron is passive. The solution of hydrogen in the surface lattice destroys passivity, the hydrogen electrons displacing Fe-Cr bonds. Chemo-sorption of oxygen may enhance the passive nature of boundary alloy compositions as well as pure metals by electron sharing similar to Cr. The present electron sharing viewpoint harmonizes many of the divergent theories concerning the passivity of pure metals and provides plausible explanation for the corrosion resistant alloys of the transition elements.

*A theory of the structure and process of formation of antibodies:* LINUS PAULING. There is developed, on the basis of structural information about simpler molecules, a theory of the structure and process of formation of antibodies which is considerably more detailed than any earlier theory. The theory accounts for many facts, such as the observed antibody-antigen ratios in precipitates, the inhomogeneity of antibodies to a given antigen, and the independence of action of antigens in an immunizing mixture. Among the predictions based on the theory are the following: that the denaturation of antibodies is irreversible; that different antibodies on denaturation and attempted renaturation become identical; that decrease in specificity of the antibody and decrease in antigenic power (amount of antibody produced) accompany increase in number of strong groups in the antigen; that a non-protein and non-polysaccharide substance may have antigenic power if it contains suitable groups and its molecules or particles are sufficiently large; that the synthesis of antibodies *in vitro* might be achieved by denaturing serum globulin and removing the denaturing agent in the presence of an antigen or haptene.

*The energy and entropy of extension and spreading of mobile monolayers:* WILLIAM D. HARKINS, T. FRASER YOUNG and EDWARD BOYD.

*The principle of sufficient reason:* GEORGE D. BIRKHOFF (by invitation). The basic importance of the principle of sufficient reason (*i.e.*, that everything has a reason) was first emphasized by the German mathematician and philosopher Leibnitz. By means of it he was led to important conclusions, such as a relativistic theory of space and time in opposition to the absolutistic theory of his contemporary, the great Newton. In fact, this principle formed the foundation of nearly all of Leibnitz's general speculations. The principle of sufficient reason is intimately connected with what may be termed the theory of ambiguity, and with the associated mathematical theory of groups. This relationship may be illustrated by means of simple examples taken from a variety of domains, in particular from mathematics and physics. The fact that the principle as yet plays very little part in biological, psychological and social theory is probably due to backwardness in these highly complex fields of thought. Furthermore, it was conjectured that, in so far as philosophical speculations of metaphysical type are valid, these are always based on the same principle. Thus the general conclusion might be symbolized as follows: Metaphysics $\longleftrightarrow$ Principle of Sufficient Reason $\longleftrightarrow$ Theory of Ambiguity = Theory of Groups.

*Nuclear fission:* K. K. DARROW (by invitation). This talk pertains to the most newly discovered and most sensational mode of transmutation, in which the entry of a neutron into a massive atom-nucleus brings about an internal explosion in which the nucleus is "fissured" or divided into two fragments which share the total mass and charge between them in nearly equal proportions. (In all other modes of transmutation except those affecting the very lightest elements, the division is into fragments of very unequal mass and charge.) The conversion of rest-mass into kinetic energy, or (as is more commonly said) the release of energy, is unprecedented in scale. A multitude of radioactive bodies, many hitherto unknown, is formed; and there is is spontaneous emission of fresh neutrons in great quantities, possibly sufficient to convert the process once initiated into a self-perpetuating one under realizable conditions.

*The origin of the submarine valleys on the continental slopes of the North Atlantic:* WALTER H. BUCHER (by invitation). Since the submarine slope topography extends to depths far greater than can be accounted for by removal of the water or vertical uplift of the shelf, the forces that produced them must lie in the ocean itself. As the ocean is a "standing" body of water, the only "currents" capable of producing erosion on the continental slope are such as arise through wave-motion. Only such waves can have an effect on the sea-bottom as have wave-

lengths much greater than the oceanic depths. Two kinds of such waves are known: the tides and seismic sea-waves. The tides produce currents sufficient to keep the submarine valleys free from finer sediment. The seismic sea-waves develop much stronger current-like movements than the tide along shores that lie within certain distances from an earthquake epicenter. They must produce correspondingly stronger action on the sea-floor. The seismic sea-waves are not superficial phenomena, but move the whole water column. They travel across the ocean with wave-lengths measured in hundreds of kilometers, in oceans a few kilometers deep. All water particles, therefore, from top to bottom move in paths that are very flat ellipses, the water traveling in one direction for five to ten minutes and then in the opposite direction with average orbital velocities more than sufficient to erode the sediments of the Atlantic slope. The movement persists for many hours, even a day and more. It is competent to notch the slope as cloudbursts notch desert hillsides. Slumping widens the cut as on land, the tides cleaning out the channel between seismic sea storms. The peculiar distribution in space and time of the cable breaks following the Grand Banks earthquake of 1929 become intelligible as a result of such subaqueous erosion. The growth of the Mid-Atlantic Ridge, largely since Miocene time, has furnished abundant volcanic and tectonic disturbances to supply energy for the observed erosion. Contemporary earthquake activity seems adequate to keep it up.

*Minute amounts of chemical elements in relation to plant growth:* D. R. HOAGLAND (by invitation). Brief survey of various aspects of the relation to plant growth of chemical elements effective in minute quantities. Following the early work of Mazé and other French investigators, of the Rothamsted Experimental Station, McHargue, and Sommer and Lipman, gradually it has become widely recognized that boron, copper, manganese and zinc have specific and indispensable functions in the metabolism of higher plants. Recent experiments give strong support for the view that molybdenum is also an essential element. Since the quantities involved are extremely minute, to prove indispensability of these elements for plant growth requires a highly refined technique. Nevertheless, deficiencies may occur under ordinary conditions of experimentation in the greenhouse and also in practical agriculture. Numerous previously obscure nutritional plant diseases can be explained on the basis of deficiency of one or more of the elements listed above. As illustrations, cases of boron deficiency in many parts of the world and the experience in California with "little-leaf" or "mottle-leaf" disease, caused by zinc deficiency, are cited. Attention is called to certain phases of the problem of availability of manganese, copper, boron and zinc in soils. Reference is made to present knowledge, still very inadequate, of the functions of these elements in plant metabolism, with respect to photosynthesis, oxidation-reduction, and other enzyme systems, nitrate utilization, etc. Problems of toxicity to the plant from excesses of such elements, especially boron, may also arise. The relation of chemical elements absorbed in small quantities by the plant to its nutritional adequacy, as animal food, has marked interest. The quantitative requirements or tolerance of the plant are not necessarily coincident with those of the animal, although minute amounts of certain metals are necessary for both plant and animal growth.

*The chemistry of marihuana:* ROGER ADAMS (by invitation). The resin exuded by the pluricellular glandulose hairs of the female hemp plant at the time of flowering contains one or more physiologically active substances. This resin is collected directly or the tops of these plants are cut and dried, the coarse material removed and the product finely ground. These hemp preparations are smoked or incorporated in candies, cakes or other articles of food to be eaten in order to produce intoxication. The name used in the United States for hemp products containing the intoxicating principle is marihuana, in India, hashish. The physiological effect in man may be described briefly as the induction of somatic and psychic changes. An attempt is being made to isolate in pure state the substance or substances causing this action. By proper extraction of the resin or the female hemp tops, a high-boiling viscous product is obtained known as "red oil," which contains an active principle. Thus far all attempts to isolate a single individual substance with marihuana action has failed. Prior to the present study a pure physiologically inactive substance, cannabinol, has been isolated from red oil by British investigators who have shown it to be a dibenzopyrane derivative. A second pure substance, cannabidiol, has now been obtained from red oil. This substance is physiologically inactive but gives many of the tests previously assumed to be characteristic of the active principle. The constitution of cannabidiol has not been fully completed, but experimental evidence indicates it to be a 2-dihydrocymyl-1, 3-dihydroxy-5-*n*-amyl benzene with the position of the two double bonds in the dihydrocymyl residue still to be located.

*Viruses and their part in disease:* W. G. MACCALLUM (by invitation). Relation of viruses to other parasites, especially in causing disease. Their form and extreme minuteness. Methods of isolation and cultivation. Their dependence upon living cells for growth. Their action in producing disease and predisposing to secondary bacterial infection. Their action in producing antibodies and life-long immunity. Their causal relation to tumor growth. The mode of transmission, often by intermediate hosts, such as mosquitoes. Their fairly specific relation to certain hosts. Recent crystallization of a virus as a nucleoprotein, perhaps with ferment activity. Question as to the borderline between inanimate and living.

BIOGRAPHICAL MEMOIRS READ BY TITLE.

*Biographical memoir of Edmund Beecher Wilson:* THOMAS HUNT MORGAN.

*Biographical memoir of Edward Leamington Nichols:* ERNEST MERRITT.

*Biographical memoir of Ambrose Swasey:* DAYTON C. MILLER.

# REPORTS

## APPROPRIATIONS OF THE ROCKEFELLER FOUNDATION FOR THE MEDICAL AND NATURAL SCIENCES IN 1939[1]

### THE MEDICAL SCIENCES

GRANTS in the medical sciences made by The Rockefeller Foundation in 1939 fall into three general groups: new appropriations in the field of psychiatry; renewals or extensions of earlier appropriations in this field, and new appropriations or renewals in support of other phases of medical research and teaching not closely related to psychiatry.

Among new appropriations in psychiatry, $106,080 was given to the University of Toronto for research on carbohydrate metabolism as related to mental disease, a joint enterprise of the Psychiatric Clinic and the physiologists of the Banting Institute, who are particularly qualified in the studies of insulin. To the Catholic University of America $85,000 was appropriated for the teaching of abnormal psychology and child psychiatry to Catholic teachers and social workers, both lay and clerical. An appropriation of $17,150 was made to the Dikemark Mental Hospital in Norway for biochemical studies of the insane. Each of these three grants was for five years or more.

Renewal of support previously given by the Foundation to psychiatric research was made to departments of psychiatry at Johns Hopkins, Harvard, Institute of the Pennsylvania Hospital, University of Illinois, University of Colorado, Tulane University, University of Oxford, University of Lund (Sweden), University of Brussels, the Tavistock Clinic (London) and to the Boston State Hospital. These 11 grants, averaging about three years in duration and approximately $37,000 in amount, involved a total of $404,750. In judging the relatively short duration of these grants, it should be noted that the Foundation had already given aid to these 11 undertakings over periods of time averaging more than four years.

Outside the program in psychiatry some relatively large grants were made in 1939 to a variety of undertakings. A conditional appropriation of $400,000 was made to Harvard University for the endowment of its School of Dental Medicine, toward which the Carnegie Corporation has pledged $650,000. This appropriation of the Foundation becomes effective when from all sources the total increase in the endowment of the school reaches $2,550,000.

For the development of an adequate department of preventive medicine and public health in the Johns Hopkins School of Medicine, an appropriation was made of $350,000, payable at the rate of $35,000 a year for ten years. Continuation of studies in endocrinology at Yale and the University of California was provided for by grants of $36,000 and $75,000, respectively. Psychological research under the direction of the Child Research Council of Denver was aided with a grant of $19,200 available over a period of six years. For the maintenance of the National Committee of Maternal Health, an independent organization selecting and administering research projects in the fields of reproduction and sex phenomena, $12,000 was appropriated over a two-year period. Support in the amount of $42,000 was renewed for a three-year period for studies in the constitutional aspects of disease, under the direction of Dr. George Draper at the School of Medicine of Columbia University. The sum of $15,000 was contributed to the development of legal medicine at Harvard over a three-year period. Two appropriations were voted of fluid research funds from which allocations are to be made by the recipient institutions to investigators and projects which they themselves select: one to the Johns Hopkins School of Medicine in the amount of $15,000 a year for six years; and one to the Medical Research Council of Great Britain for research in endocrinology, psychiatry, neurology and allied subjects, in the amount of $10,000 a year for five years.

### THE NATURAL SCIENCES

As has been stated, the present program of the Foundation in the natural sciences places primary emphasis on experimental biology. This program is based upon the conviction that man will profit enormously from a deeper and clearer understanding of the phenomena of life. It is particularly concerned in helping to bring to bear upon these complicated and subtle problems all the battery of modern precision techniques. It is interested in the way inheritance operates, in the way cells grow and divide, in the way genetic characteristics find their physiological expression, in the physical and chemical control of growth and development, in the biochemical aspects of nutrition and in a variety of other matters involved in understanding the details of life processes.

One group of 1939 appropriations was related to the application of chemistry to biological problems. A five-year grant was made to the University of Utrecht for research under Professor F. Kögl on the biochemistry of growth substances. Two grants were made to the University of Minnesota: one provides assistance over five years to Professor G. O. Burr for studies of certain substances (lipids) which play a vital role in

[1] From the annual review of the president of the Rockefeller Foundation, Dr. Raymond B. Fosdick.

cellular activities; the other gives aid over three years to researches under Professor M. V. Visscher on the mechanism of osmosis in living systems. To the Johns Hopkins University a four-year appropriation was made for a group program on the chemical structure of biologically important compounds. To Oxford University funds were voted to build an extension to the research laboratory of organic chemistry under Sir Robert Robinson. The five appropriations in this group totaled $197,875.

A second group of appropriations emphasized the application of physics to biological problems. Funds were given to Washington University, St. Louis, to construct a cyclotron which will be used in biological and medical experimentation; and a three-year grant was made to Professor Lawrence's group in support of similar activities at the University of California. A three-year grant to the University of Chicago is assisting studies in molecular spectra, under Professor R. S. Mulliken. The Memorial Hospital of New York received a grant covering three years, for research in the spectroscopic aspects of anemia, under Dr. C. P. Rhoads. The four grants in this group totaled $149,000.

Two grants were made in the field of genetics. The University of Missouri, where there has been an important recent development in this subject, was assisted in building a research laboratory of genetics, and was given a five-year grant toward its research program. An appropriation covering five years was made to Brown University to aid the genetics researches of Professor P. B. Sawin. These two grants totaled $109,000.

A five-year grant to the biology group at Amherst College also involved support of genetics, as well as of experimental embryology and growth studies. Such assistance to groups or departments, in contrast to support of specific projects, has been an important part of the division's program. Thus during 1939 a ten-year grant was made in support of research in biology at Stanford University. Also involving assistance to a group activity was a grant in support of the Cold Spring Harbor symposia on quantitative biology. The appropriations in this classification totaled $242,500.

Emphasis on several interests of the Foundation was included in a grant of $224,000 in support of further activities of the Yale Laboratories of Primate Biology. A minor portion of this sum covered the cost of erecting and equipping a small new physiological laboratory at Orange Park, Florida, where there are already located extensive facilities for breeding and rearing chimpanzees for research purposes. The remainder of the grant will contribute, over a five-year period, to the support of a general program in which these animals, so close to man in many important regards, are to be utilized in the study of a wide range of physiological, psychobiological, neurological, nutritional, serological and biochemical problems.

In addition to these appropriations, funds were voted to the National Research Council in support of its general budget (61,956.54) and of its fellowship program ($180,000).

Once during the year an appropriation was made for a purpose somewhat removed from the program of the Foundation in the natural sciences under its policy of concentration. Political interference in Germany having threatened the integrity of the leading world journal for abstracting mathematical literature, a grant was given to the American Mathematical Society to aid in the founding of such a journal in the United States. The editorial offices of this new journal are at Brown University. A second grant was made for the establishment of a microfilm laboratory at Brown, through which an important microfilm service in mathematics has been set up in conjunction with the new journal. These two grants totaled $61,500.

# SPECIAL ARTICLES

## ASSOCIATION OF THE HETEROGENETIC ANTIGEN WITH A MATERIAL IN NORMAL AND TUMOR TISSUES SEDIMENTABLE AT HIGH SPEED[1]

THERE have been numerous investigations[2, 3, 4] on the nature of the substances in tissues of different species and in micro-organisms which have the ability to produce hemolysins in rabbits against sheep erythrocytes. The procedures applied to the characterization of these substances were usually drastic and yielded no precise information concerning the antigenic substances as they occur in tissues although they contributed greatly to the knowledge of its hapten, that is, the part of the molecule determining immunological reactivity.

Studies on the nature of agents producing leukosis and sarcoma of chickens have shown that they can be sedimented in the ultracentrifuge at 27,000 rpm for one hour and are associated with a normal substance which has approximately the same sedimentation rate.[5, 6, 7] Immunological studies failed to show dif-

[1] These studies have been supported by the Jane Coffin Childs Memorial Fund, the International Cancer Research Foundation and the Anna Fuller Fund.

[2] K. Landsteiner, "The Specificity of Serological Reactions," C. C Thomas, Springfield, Illinois, 1936.

[3] F. E. Brunius, Dissertation, Stockholm, 1936.

[4] H. Schmidt, "Die Heterogenetische Hammelblut Antikörper und Ihre Antigene," Leipzig, 1924.

[5] A. Claude, SCIENCE, 90: 213, 1939.

[6] K. G. Stern, *et al.*, SCIENCE, 89: 609–610, 1939.

ferences between the heavy substance obtained from chicken tumors and from normal chicken spleens[8] and suggested that the agent might be present in tumor extracts in concentrations too small to produce antibodies on injection. The possibility that the agent and the heavy material present in normal tissues are closely related can not be excluded and, indeed, Claude[9] assumes the agent is but a modified form of the normal heavy material.

The fraction sedimentable in the ultracentrifuge from normal and tumor tissues has been shown to consist of lipoid and nucleoprotein.[10] Because of its complex nature, it was desirable to use the sensitive immunological properties as a guide to further chemical differentiation. Both species and organ specificities of these substances were studied.

Tissues were ground in the cold with sand and saline and clarified by preliminary centrifugation at 8000 rpm. The heavy fraction was obtained by centrifugation at 27,000 rpm for one hour. The supernatant was decanted and the sediment washed and suspended in saline.[11] Antisera were prepared in rabbits by injections of sediment resuspended in saline.

It was noted in the course of these studies that immune sera directed against high speed deposits from normal chicken spleen contained two different antibodies. One of these agglutinated and hemolyzed sheep cells in high dilutions and may be regarded to be a heterogenetic or Forssman (F)[12] antibody; the other (Ts) is species specific and reacts with high speed deposits of tissue extracts even after their immune sera have been deprived of the F antibodies by absorption with sheep erythrocytes. Heating to 100° C. for one hour destroyed reactivity of the species specific antigen but had no effect upon the heterogenetic component (Table I). An antiserum prepared by immunizing rabbits with the heavy fraction of chicken spleen heated to 100° C. produced only heterogenetic antibody (Table II).

TABLE I

DEMONSTRATION OF HETEROGENIC AND SPECIES SPECIFIC ANTIBODIES IN ANTISERUM TO A MATERIAL FROM CHICKEN SPLEEN SEDIMENTABLE AT 27,000 RPM

| | Serum dilutions 50 | 150 | 450 | 1350 | 4050 | 12150 |
|---|---|---|---|---|---|---|
| I. Serum (#26) unabsorbed | | | | | | |
| Complement fixation with homologous heavy material | | | | | | |
| (a) unheated ..... | – | 0 | tr | c | c | – |
| (b) heated to 100° C. during 1 hour . | – | 0 | 0 | c | c | – |
| Hemolysis of sheep erythrocytes ..... | – | c | c | c | sl | 0 |
| II. Serum (#26) absorbed with sheep erythrocytes | | | | | | |
| Complement fixation with homologous heavy material | | | | | | |
| (a) unheated ..... | – | 0 | c | c | – | – |
| (b) heated to 100° C. during 1 hour . | ac | c | c | c | – | – |
| Hemolysis of sheep erythrocytes ..... | 0 | 0 | 0 | – | – | – |

0 = no hemolysis, tr = trace, sl = slight, st = strong, ac = almost, c = complete hemolysis.

TABLE II

ANALYSIS OF IMMUNE SERUM AGAINST HEAVY MATERIAL OF CHICKEN SPLEEN HEATED TO 100° C. DURING 1 HOUR

| | Serum dilutions 50 | 100 | 200 | 400 | 800 | 1600 |
|---|---|---|---|---|---|---|
| I. Serum (#45) unabsorbed | | | | | | |
| Complement fixation with heavy fraction | | | | | | |
| (a) unheated ..... | – | 0 | 0 | 0 | tr | – |
| (b) heated to 100° C. during 1 hour . | – | 0 | 0 | mod | c | – |
| Hemolysis of sheep erythrocytes ..... | – | – | – | c | c | st |
| II. Serum (#45) absorbed with sheep erythrocytes | | | | | | |
| Complement fixation with heavy fraction | | | | | | |
| (a) unheated ..... | st | c | c | – | – | – |
| (b) heated to 100° C. during 1 hour . | mod | c | – | – | – | – |
| Hemolysis of sheep erythrocytes ..... | 0 | 0 | 0 | – | – | – |

Immune sera prepared with the high speed sedimentable fractions of a chicken tumor (Strain 13[13]) likewise contained the two antibodies (Ts and F). Alcoholic extracts of chicken spleen reacted only with the F antibody; they were not antigenic themselves but produced F antibodies when injected into rabbits mixed with pig serum.

These rabbit immune sera against the high-speed sedimentable fraction of chicken spleen and chicken tumor reacted strongly in complement fixation tests with similar deposits from mouse and guinea pig spleen but did not react with a similar fraction from rabbit

TABLE III

REMOVAL OF CROSS REACTING ANTIBODIES FROM ANTISERUM TO HEAVY MATERIAL FROM CHICKEN SPLEEN BY ABSORPTION WITH SHEEP ERYTHROCYTES

| Antiserum (#26) to high speed sediment from chicken spleen | Serum dilutions | High speed sediment from spleen: Chicken | Mouse | Guinea pig | Hemolysis of sheep erythrocytes |
|---|---|---|---|---|---|
| Unabsorbed | 1/150 | 0 | 0 | 0 | c |
| | 1/450 | 0 | 0 | 0 | c |
| | 1/1350 | c | ac | c | c |
| | 1/4050 | c | c | c | sl |
| | 1/12150 | – | – | – | 0 |
| Absorbed with sheep erythrocytes | 1/50 | – | c | c | 0 |
| | 1/150 | 0 | c | c | 0 |
| | 1/450 | c | c | c | 0 |

[7] E. A. Kabat and J. Furth, *Jour. Exp. Med.*, 71: 55, 1940.
[8] *Ibid.*
[9] A. Claude, *op. cit.*
[10] *Ibid.*
[11] E. A. Kabat and J. Furth, *op. cit.*
[12] Abbreviations: F = Forssman, T = tissue antigen.
[13] E. L. Stubbs and J. Furth, *Jour. Exp. Med.*, 61: 593, 1935.

spleen. Absorption tests indicate that this group reaction is entirely heterogenetic since all of the cross reactivity can be removed by absorbing the serum with sheep erythrocytes (Table III).

The possibility of obtaining specific reagents for each of the two identified components present in the heavy fractions of organs and in tumor extracts permitted an assay of these antigens in the crude extract and its fractions. The specific F serum was obtained by immunization of rabbits with the heavy material from chicken spleen heated to 100° C. for one hour; the species specific antibody was obtained by absorbing serum against unheated high speed deposits of chicken spleen, with sheep erythrocytes. The assay of the F antigen was complemented by specific inhibition tests made according to the technic of Brahn and Schiff.[14]

Table IV shows that the heterogenetic antigen present in tumor extracts is sedimented at high speed

TABLE IV

ASSOCIATION OF FORSSMAN AND TISSUE SPECIFIC ANTIGENS WITH THE HEAVY FRACTION OF TUMOR EXTRACT

| Antigen | Total N concentration | Antigen dilutions | Complement fixing power of extract: Antiserum to high speed deposit from tumor, absorbed with sheep erythrocytes (Assay for Ts) | Complement fixing power of extract: Antiserum to high speed deposit from tumor, heated to 100° C. during 1 hr. (Assay for F) | Inhibition of sheep cell hemolysis (Assay for F) |
|---|---|---|---|---|---|
| | mg/ml | | | | |
| A | 2.30 | 1/16 | 0 | 0 | 0 |
| Crude extract | | 1/32 | 0 | tr | ac |
| | | 1/64 | 0 | ac | c |
| | | 1/128 | st | c | |
| | | 1/256 | ac | | |
| B | 1.90 | 1/8 | 0 | c | ac |
| Supernatant after centrifugation at 27,000 rpm for 1 hour | | 1/16 | tr | c | c |
| | | 1/32 | st | c | |
| | | 1/64 | c | c | |
| C | 0.42 | 1/32 | 0 | 0 | 0 |
| Fraction sedimented at 27,000 rpm for 1 hour | | 1/64 | 0 | 0 | ac |
| | | 1/128 | tr | ac | c |
| | | 1/256 | ac | c | |

In complement fixation tests serum Ts was used in dilution 1:75, serum F in dilution 1:200. In the inhibition reaction approximately 2 units of hemolysin were used (Serum F diluted 1:2500). Antigens and sera alone did not fix complement in the dilutions tested.

together with a species specific antigen (or antigens). Similar results were obtained with extracts from chicken spleen. Centrifugation at 27,000 rpm for one hour invariably concentrated both the Forssman and species specific antigens though small amounts of both often remained in the supernatant.

*Summary.* These studies show that there is in tissue extracts a material sedimentable at high speed with which are associated two distinct immunological specificities. One of these is heat labile and is species specific; the other is heat stabile and is identical with the heterogenetic (Forssman) antigen. Antisera containing specific antibodies for each have been prepared. Experiments are in progress to determine whether the heavy species specific substance and the F antigen are distinct chemical entities or whether the F hapten is part of the former.

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[14] B. Brahn and F. Schiff, *Klin. Woch.*, 8: 1523, 1929.

## ELECTROPHORETIC ANALYSES OF HYPERIMMUNE SERA

TISELIUS and later other investigators have shown that the normal sera of many animals, including the horse, contain four components. One of these is the albumin; the other three, globulins, are commonly designated α, β and γ. Tiselius and Kabat[1] described an antipneumococcic horse serum in which the activity seemed to be associated, not with one of these globulins, but with a new component having a mobility between those of β and γ. In a previous note we described[2] results of an electrophoretic study of a number of antipneumococcic horse sera. All these hyperimmune sera showed only the three normal globulins, increase in antibody content being in each case reflected by an increase in the γ-component. We have also published[3] electrophoretic analyses of a number of tetanus antitoxic sera. There is reason to believe that their antitoxin is associated with a new (T) component rather than with the γ-globulin. This T-component has essentially the same mobility as the antipneumococcic component of Tiselius and Kabat $-u = ca - 2.2 \times 10^{-5}$ $cm^2\ sec^{-1}\ volts^{-1}$. A globulin of similar mobility has been seen in diphtheria antitoxic sera by Pappenheimer, Lundgren and Williams.[4]

This apparent association of antibody activity sometimes with one serum constituent and sometimes with another presents an interesting series of problems. In a previous paper[5] we suggested that since all our antipneumococcic sera were from horses long subject to hyperimmunization the antibody mobility might change as immunization proceeds. Since then we have examined serum drawn from a horse about six months after the start of hyperimmunization. Its electro-

[1] A. Tiselius and E. A. Kabat, SCIENCE, 87: 416, 1938; *Jour. Exp. Med.*, 69: 119, 1939.

[2] D. H. Moore, J. van der Scheer and R. W. G. Wyckoff, SCIENCE, 90: 357, 1939.

[3] J. van der Scheer and R. W. G. Wyckoff, *Proc. Soc. Exper. Biol. and Med.*, 43: 427, 1940.

[4] A. M. Pappenheimer, H. P. Lundgren and J. W. Williams, *Jour. Exper. Med.*, 71: 247, 1940.

[5] D. H. Moore, J. van der Scheer and R. W. G. Wyckoff, *Am. Jour. Immunol.*, 38: 221, 1940.

phoretic pattern did not differ essentially from that of serum from a horse that had been producing pneumococcic antiserum for ten years. We have also found no significant difference on electrophoresis between tetanus antitoxic sera drawn from horses four and 30 months after beginning hyperimmunization.

Recently we have completed the electrophoretic study of the sera of horses hyperimmunized with a number of antigens of bacterial origin. Some have shown with more or less prominence the T-component absent in normal sera; others have shown no T but, like our pneumococcic antisera, an enhanced γ-glubulin peak. Antitoxic sera against Cl. welchii, Cl. sordelli and Cl. oedematiens, as well as against C. diphtheriae and Cl. tetani show large T components. Scarlet fever, botulinus, staphylococcus, histolyticus and vibrion septic antitoxic sera have also contained some T-globulin. In certain of these sera there has been more T than γ, in others it has been present in small amounts only. The amount of γ in these sera has been greater than in normal sera. Several antisera against the meningococcus have resembled our antipneumoncoccic sera both in the extraordinarily large amounts of γ and in the absence of detectable amounts of T. Sera against the organisms of hemolytic septicemia and swine erysipelas have also been very rich in γ. The latter serum has shown a small amount of a component having approximately the mobility of T. A serum against the Shiga and Flexner strains of dysentery bacteria has contained both T and a moderately enhanced γ. These various sera have been taken, some from freshly immunized horses, others from old serum producers.

All these results make it clear that horses respond to some antigens by an increase in the already existing γ-globulins, to others by the production of a new T component. In the experiments here reported all antitoxic sera have contained T while the most impressive increases in γ have been seen in anti-carbohydrate sera. More work will, however, be needed before we can specify those qualities of an antigen which determine the production of a T or a γ antibody.

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## ON THE URINARY EXCRETION OF "FREE" SULFAPYRIDINE

Certain theories relative to the mode of action of the sulfanilamide series of drugs involve oxidation-reduction mechanisms. We have isolated a monohydroxyl derivative of sulfapyridine from dog urine following the administration of the drug. The compound melts at 180°–181° (corr.) and depresses the melting point of sulfapyridine. The ultra-violet absorption data are shown in Fig. 1. The compound gives a

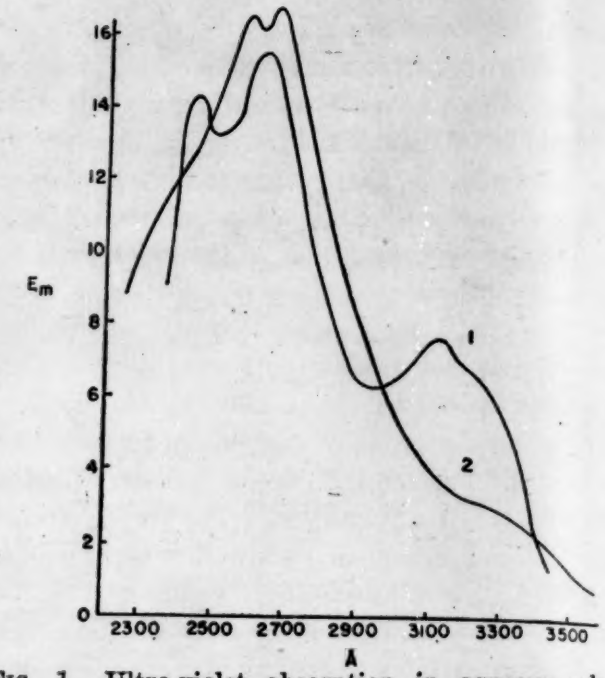


Fig. 1. Ultra-violet absorption in aqueous solution. 1. Sulfapyridine. 2. Hydroxy-sulfapyridine.

positive diazo and ferric chloride reaction.

Calculated for $C_{11}H_{11}O_3N_3S$:
C = 49.81; H = 4.15; N = 15.84.
Found:
C = 50.33; H = 4.26; N = 15.96.

A glucuronate of this substance has been isolated and characterized as its silver salt.

Calculated for $C_{11}H_9O_2N_3SAg \cdot OC_6H_9O_6Ag \cdot 3H_2O$:
C = 28.77; H = 3.24; N = 5.92: Ag = 30.46; $H_2O$ = 7.61.
Found:
C = 28.98; H = 3.38; N = 5.73; Ag = 30.16; $H_2O$ = 6.85.

Since the hydroxy-sulfapyridine glucuronate is very water-soluble, this product is of interest in relation to the problem of the formation of renal calculi.

John V. Scudi

Laboratory of Research
and Development,
Merck and Co. Inc.,
Rahway, N. J.

## BOOKS RECEIVED

Cushman, Joseph A. *Foraminifera; their Classification and Economic Use.* Third edition, revised. Pp. viii + 535. Illustrated. Harvard University Press. $6.00.

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